1-2+9-02, Sep. 12+Nov. 5

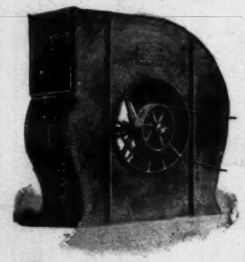
DOMESTIC ENGINEERING

Whole Number 137 *Chicago and New York, March Fifteenth, Nineteen Hundred and One* *Vol. 20, No. 6*

NEW YORK, BOSTON, MINNEAPOLIS, DENVER, PHILADELPHIA, ST. LOUIS, LONDON, HAMBURG **AMERICAN RADIATOR CO.** GENERAL OFFICES LAKE & DEARBORN STS. CHICAGO.

DON'T SWEAR
USE OUR INCANDESCENT MANTELS IN 1901
Harding Incandescent Co.
HARDING BLDG.
CHICAGO.

BUFFALO FAN SYSTEM



OF HEATING VENTILATING AND DRYING

BUFFALO FORGE COMPANY
BUFFALO, N. Y.

F. E. Cudell's PATENT sewer gas and back-water trap

S+S¾S R. B.

for wash bowls, sinks, bath and wash tubs

Put into the White House by the U. S. government. For venting use vent trap.

CLEVELAND, OHIO

PATTERNS
GOBEILLE PATTERN CO. Cleveland, O.

Mantle Chemicals
The Roessler & Hasslacher Chemical Co.
Office: 100 William St., New York.
Chicago Office: 16 N. Clark Street.

See our Advertisement...Page 47

WHAT A DIFFERENCE
In the quality of Plumbing work.
RAYMOND'S

COMBINATION FERRULES MAKE RELIABLE CONNECTIONS BETWEEN LEAD AND IRON PIPES.

WHY?

Because they have an extra thickness of lead over the shoulder, giving strength where it is needed, and where other Lead Ferrules are weak.

The genuine article bears our label.

RAYMOND LEAD COMPANY, CHICAGO.

"Readers give attention to advertisements to which attention has been given."

'96 JENKINS' '96 SHEET PACKING
Pronounced by steam users throughout the world the best joint packing manufactured. Expensive? Not at all, as it weighs 30 per cent., less than many other packings, consequently is much cheaper.
JENKINS BROS., N. Y., Boston, Phila., Chicago.

REFLECTION IS ECONOMY
where lighting is concerned. The best reflection is the greatest economy. If my reflectors cost a little more than others, they are the cheapest to buy, because they economize the most.
I. P. FRINK, 551 Pearl St., N. Y. City

The Pattern Shop of the East
H. B. OLMSTEAD & CO.
87 FRANKFORT ST NEW YORK

MICA INSULATING JOINTS
GAS, ELECTRIC AND COMBINATION FIXTURES
J. L. OEFINGER MFG. CO.
14 N. CANAL ST. CHICAGO, ILL.

WATER SUPPLY BIG VOLUME LIFTS
L. E. RHODES CO.
HARTFORD, CT.

SEE ADV. ON PAGE FOUR
Paragon Boiler
ISAAC A. SHEPPARD & CO., - PHILADELPHIA

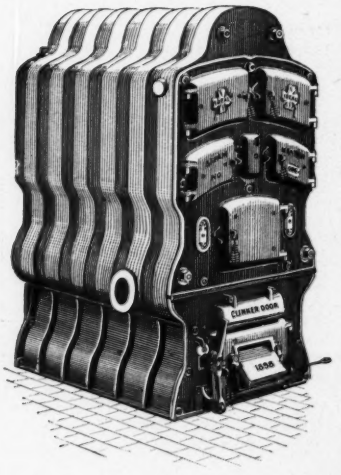
Jobbers and Manufacturers
Directory for Nineteen Hundred and One. New Edition. Now Ready. Price, Five Dollars.
Domestic Engineering, 58-64 North Jefferson Street, Chicago.

OHIO STATE UNIVERSITY LIBRARY

"Things small, but significant, soon become important."

We feel that the many little important improvements made in

our 1901 line



of Ideal Boilers will strengthen and continue the high regard in which they are held by those who appreciate the fine points in boiler construction. May we furnish you our latest descriptive catalogue and prices?

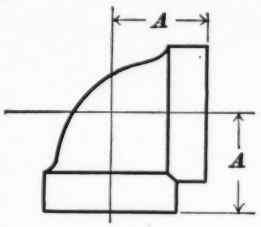
AMERICAN RADIATOR COMPANY

Lake and Dearborn Streets

CHICAGO

NEW YORK
BUFFALO
MINNEAPOLIS

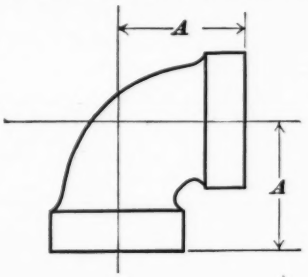
PHILADELPHIA
ST. LOUIS
DENVER



CRANE DRAINAGE FITTINGS

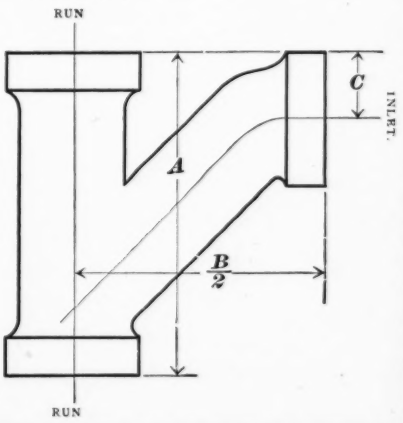
FOR THE WROUGHT PIPE SYSTEM OF DRAINAGE

THESE FITTINGS ARE MADE WITH AN INSIDE SHOULDER. THE PIPE SCREWS IN UP TO THE SHOULDER, MAKING A PERFECTLY FLUSH JOINT, THUS LEAVING NO POCKETS FOR SOLID MATTER TO LODGE IN AND CHOKE UP THE PIPE.



GALVANIZED AND MALLEABLE IRON DRAINAGE FITTINGS MADE TO ORDER

CAST IRON.



SEND FOR SPECIAL DRAINAGE FITTING CIRCULAR AND ILLUSTRATED AND DESCRIPTIVE CATALOGUE.

NEW YORK
PHILADELPHIA
CINCINNATI
KANSAS CITY
SIOUX CITY
OMAHA

CRANE CO.
CHICAGO
ESTABLISHED 1855

ST. PAUL
ST. LOUIS
LOS ANGELES
SAN FRANCISCO
PORTLAND, ORE.

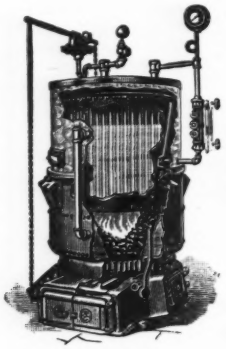
Iron Cocks

Improved Design, combining added strength, larger plug with opening full area of pipe, wide bearing to withstand heavy pressures.

Western Tube Company

Factory and General Offices: KEWANEE, ILL.

Branch Offices: CHICAGO, ST. LOUIS, NEW YORK, MINNEAPOLIS, SAN FRANCISCO



Hard Coal Boiler.

The Gorton Side Feed Boilers

You want the best, We have it.

FOR STEAM AND HOT WATER HEATING.

Send for Catalogue and Investigate for Yourself.

96 Liberty Street, New York. Old Colony Bldg. Chicago.
77 Oliver Street, Boston, Mass. Prudential Bldg. Atlanta, Ga.

GORTON & LIDGERWOOD CO.

Soft Coal Boiler.

IT IS HARD WORK
to sell steam or hot water boilers that are not modern in construction and well made. Paragon Boilers are made in the modern way—of vertical cast iron sections mounted from side to side—and the benefit of over 40 years of experience goes into every one.
ISAAC A. SHEPPARD & CO.
New York Philadelphia Baltimore
CHARLES AUSTIN BATES N.Y.

HOLLAND RADIATORS

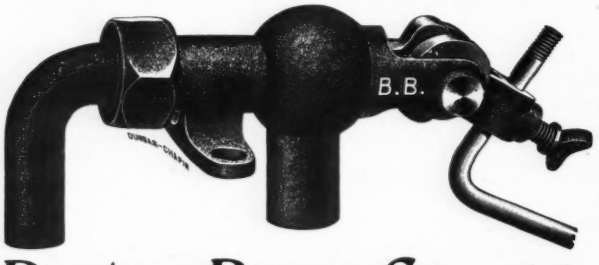
CHICAGO OFFICE, 38 DEARBORN ST. DENVER, COLO., OFFICE, 1759 STOUT ST.
WORKS, BREMEN, INDIANA.

AGENTS: KANSAS CITY, MO., U. S. Water & Steam Supply Co. CLEVELAND, OHIO, The George Worthington Co.

At above points a complete line of our Bremen-Reliance-Eclipse and Unique Radiators are carried.
Permit us to demonstate how well we can serve you.

HOLLAND RADIATOR COMPANY

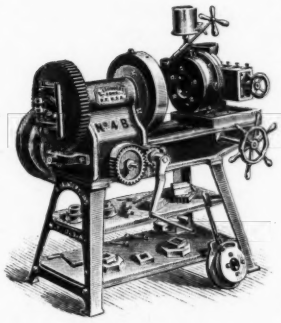
THE B. B. HIGH-PRESSURE BALL COCK



THE SIMPLEST AND BEST COCK EVER MADE.

No special packing required. Ground joint coupling which is always tight. Roller bearing lever on cam, reducing friction to lowest amount. No hammering, no singing or whistling. Has only one packing which is easily removed. Removable seat of best steam metal. We are making Floats stamped with our B. B. which are thoroughly guaranteed. Ask your jobbers for them.

Boston Brass Co., 36 & 40 Oliver St., Boston, Mass.



No. 4 B. Pipe Cutting and Threading Machine, ⅛-inch to 4 inches. Hand or Power.

D. SAUNDERS' SONS,

Manufacturers of Patent.

HAND PIPE CUTTERS

IN THREE STYLES.

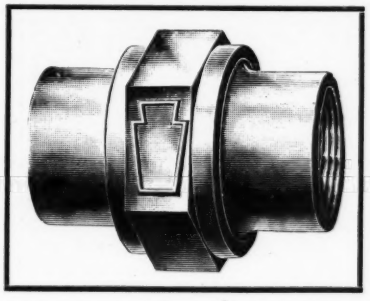
One Wheel and Roller Cutter; Three Wheeled Cutter; Tool Cutter,

FOR CUTTING BRASS, COPPER AND WROUGHT IRON TUBES.

Also Manufacturers of Pipe Cutting and Threading Machines 1-4 to 16 in., Hand or Power.

Send for Catalogue. 35 Atherton Street, YONKERS, N. Y.

KEYSTONE UNIONS



Malleable Iron,

WITH

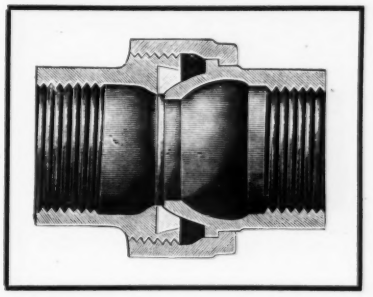
SOFT METAL SEAT

Are Always Tight.

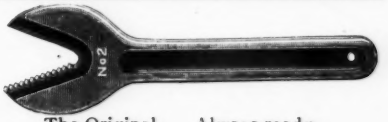
MANUFACTURED BY

Stanley G. Flagg & Co.

NEW YORK PHILADELPHIA



The Two Great Wrenches



THE "TRIUMPH" and THE "ALLIGATOR"

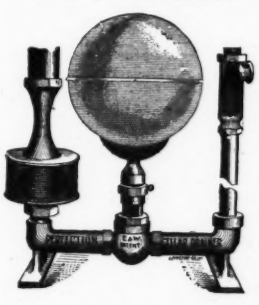
The Original. Always ready.
The Reliable. Always positive.
The Genuine. Never slips.

Never loses its grip or its handle.
Never crushes or locks on the pipe.
Can be used as a monkey-wrench or pipe-wrench.
Write for circulars and prices and mention DOMESTIC ENGINEERING

American Saw Company, Trenton, N. J.

We Want You

When in the market for



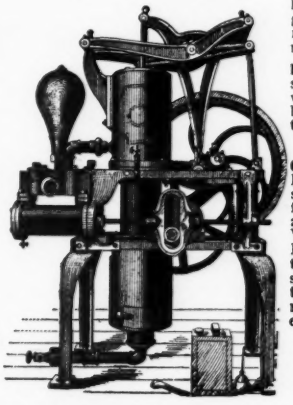
Hot Air Pumping Engines

Hydraulic Pumps

or

Cellar Drainers

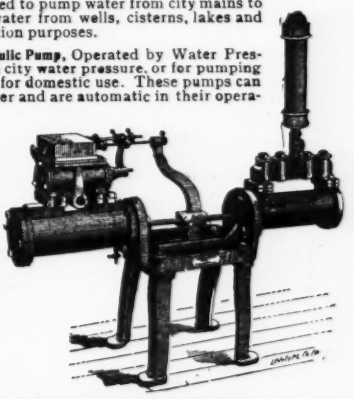
to let us tell you about our devices and quote prices



Erwin-Welch Hot Air Pumping Engine, Operated by use of gas, coal, gasoline or kerosene oil. Used to pump water from city mains to roof tanks or for pumping water from wells, cisterns, lakes and rivers for domestic or irrigation purposes.

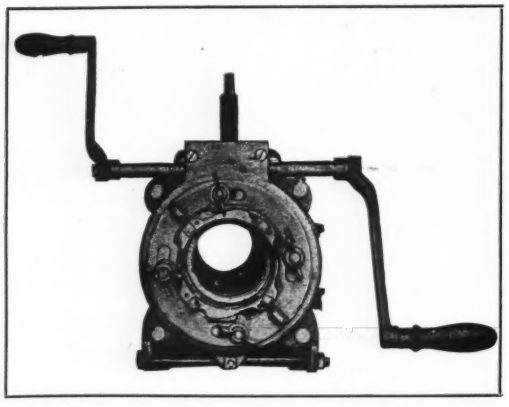
Erwin-Welch Automatic Hydraulic Pump, Operated by Water Pressure Only. Used to increase city water pressure, or for pumping water from wells or cisterns for domestic use. These pumps can be used without wasting water and are automatic in their operation. Built in 25 sizes.

Our Perfection Cellar Drainer Is operated by water or steam pressure. Used to force out water that may accumulate in Cellars, Wheel Pits, Foundation, Ditch and Pit Excavations, etc. The Drainer stops and starts automatically. Is the strongest, most durable and most efficient made.



Descriptive Circulars Sent Upon Request

ERWIN & WELCH, Manufacturers, 35 and 37 S. Canal Street, CHICAGO



Combination Vise
and
Screw Cutting Machinery

SAVES TIME AND MONEY

SEND FOR CATALOG AND PRICES

HICKMAN-MELHORN CO.

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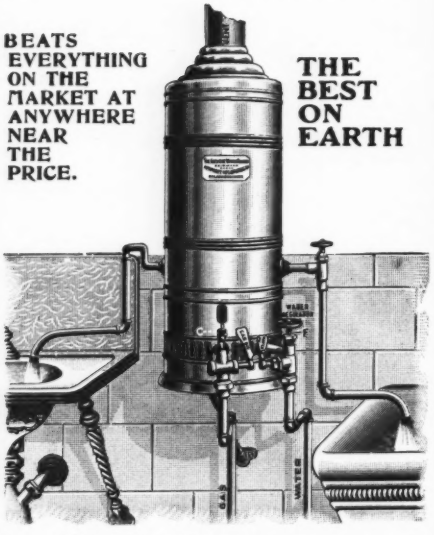
The Policy of this Journal

WE believe success—long continued, permanent success—can only be achieved in the newspaper business by conducting it in the same way a man builds a good reputation—it must have character back of it, and character, a strong character, must be based on honest intention. We all slip up in fulfillments, but good intent is necessary if good fulfillment ever comes. Our intent is to print the best trade journal in the world, in the best way, seeking for the best result. If you think we are falling short of the mark, in the interest of good results, please let us know.

DOMESTIC ENGINEERING,
JNO. K. ALLEN, President.

BEATS EVERYTHING ON THE MARKET AT ANYWHERE NEAR THE PRICE.

THE BEST ON EARTH



This is our No. 8 Crescent Heater.

Do You Sell Instantaneous Water Heaters? Then

GET IN LINE

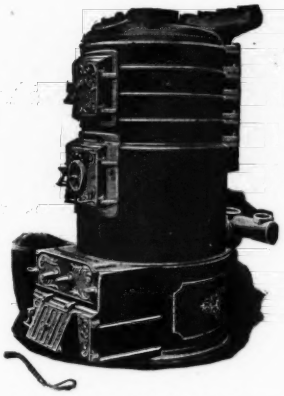
TO PUSH THE

Humphrey Crescent Instantaneous Water Heaters

We guarantee everything exactly as represented. Our prices are the **LOWEST**. If you cannot sell them, write and we will tell you how to do it and send you our new catalogue.

The Humphrey Mfg. & Plating Co.

KALAMAZOO, MICH., U. S. A.



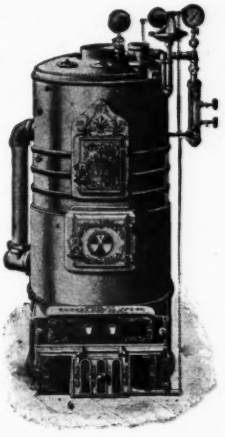
Gurney 400 Series Hot Water Heater.

Gurney

HOT WATER HEATERS
Steam Boilers
AND
RADIATORS

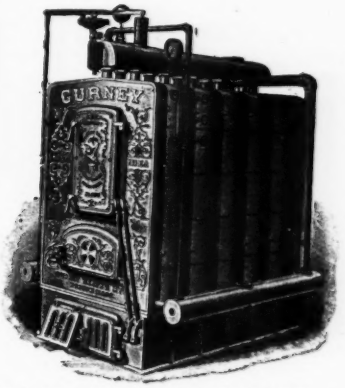
Represent **Progression** and **Advancement** in the Manufacture of Successful **Heating Apparatus.**

SOLD ONLY THROUGH THE TRADE.



Gurney 400 Series Steam Boiler.

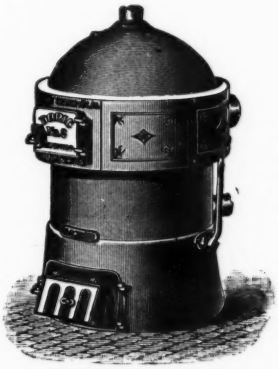
THE STANDARD OF THE WORLD for their Respective Requirements.



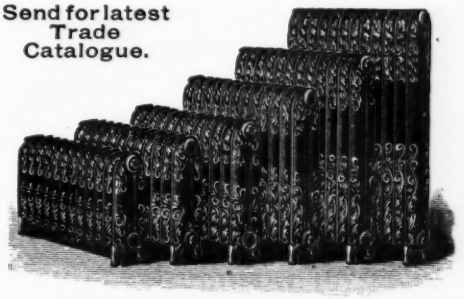
"Bright Idea" Steam Boiler, Sectional View.

For Durability, Efficiency and Economy, They Continue To Be Unsurpassed.

Send for latest Trade Catalogue.



Doric Hot Water Heater.



Duet Radiators for Hot Water and for Steam.

GURNEY HEATER MFG., CO.
74 Franklin St., Cor. Arch, BOSTON, MASS.
New York Branch: 111 Fifth Ave., cor. 18th St., N. Y.
Western Selling Agents: JAMES B. CLOW & SONS, 222-224 Lake St., Chicago.

Henderson Heaters

HAVE A SPECIAL DEVICE FOR

Burning the Gases

which commonly go unburned to the chimney. Without this device these heaters are equal to any made.

WITH IT THEY STAND ALONE.

The Prizer-Painter Stove and Heater Co.

READING, PA.

34 NORTH CANAL STREET
CHICAGO

284 AND 286 PEARL STREET
NEW YORK

PATENTED Dec. 9, 1890.
Feb. 2, 1892. June 14, 1892.
Other patents pending.

VACUUM VALVE No. 7

PERFECTED=DUPLEX

Steam Air Valve will automatically vent the radiator of the air, close by

FLOTATION AGAINST WATER and by **EXPANSION AGAINST STEAM**

After the air has been expelled from the radiator the **vacuum feature,** in the **top part of the valve,** is brought into service by the **phosphor bronze ball seating itself** so as not to permit any air to enter into the radiator through the valve, thus causing a vacuum, thereby necessarily **reducing consumption of fuel,** and with the valuable feature of locked shield which prevents tampering, must appeal to every user.

The **radiation surface** is **entirely heated,** which a steam heating **contractor will appreciate,** where contracts stipulate degree of temperature required.

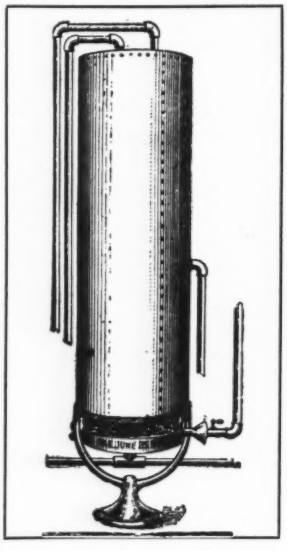
PRICE, $2.00 EACH

Manufactured by *Monash-Younker Co.*

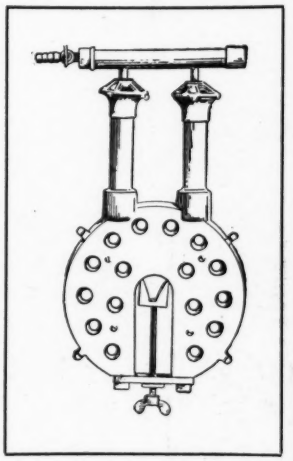
203 S. CANAL STREET CHICAGO

43 CENTRE STREET NEW YORK

THE A. HELLER HEATER



A GAS WATER HEATER



Is just the thing your Customer wants. It's the most Economical and Common Sense Heater ever put on the Market. It will supply the Kitchen and Bathroom with hot water. This heater is attached to the kitchen boiler and takes the place of the kitchen range as far as water heating is concerned, allowing the hot fire in the range to be dispensed with during the summer months. If a gas stove is used when cooking this heater will furnish hot water when wanted.....

PERFECT COMBUSTION NO ODOR
NO DIRT NO SMOKE

Heats in less time, and for less cost than any gas or coal stove in the market.....

SOLD TO THE PLUMBING TRADE ONLY---WRITE FOR CIRCULARS AND PRICES

J. P. B. SADTLER & CO., 813 SOUTH HOWARD STRET, **BALTIMORE, MD.**

WALLACE L. PIERCE, PRESIDENT
GEO. B. LITTLE, VICE-PRESIDENT

OSBORN B. HALL
GEN'L MANAGER MECHANICAL DEPT.

GEO. T. COPPINS, SECRETARY
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Walworth Manufacturing Co.

TOOLS AND SUPPLIES

FOR STEAM, WATER AND GAS USERS

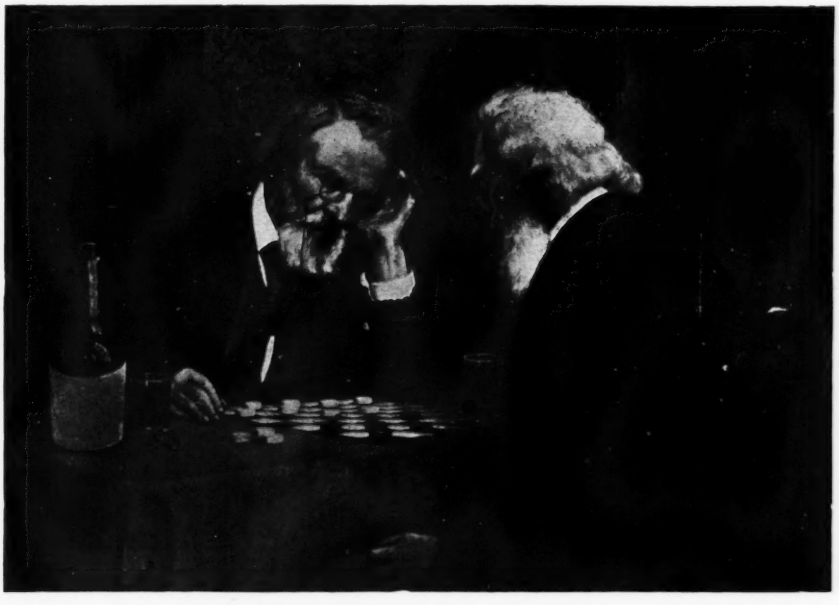
ESTABLISHED
1842

INCORPORATED
1872

128 TO 136 FEDERAL STREET
BOSTON, MASS., U. S. A.

NEW YORK OFFICE, PARK ROW BLDG.
FACTORY, SOUTH BOSTON

THE AMERIGAN PROGESS ENGRAVING GOMPANY

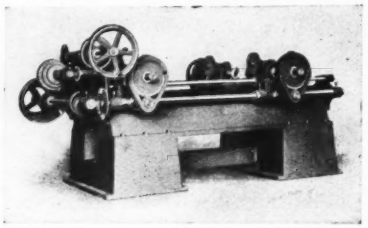


MAKERS
OF
FINE
CATALOGUE
ILLUSTRATIONS

15 to 17 WEST SIXTH STREET, GINGINNATI, OHIO, U. S. A.

This 4 Spindle Heater Drill

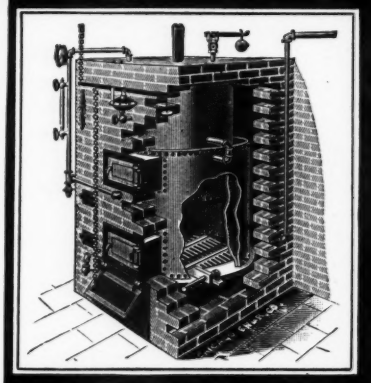
is designed for boring, facing and tapping radiator, heater and boiler sections.
Spindles have both hand and power feed, quick advance



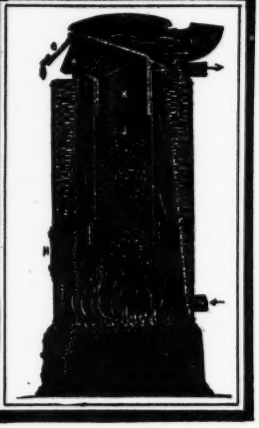
and return and automatic stop, and will bore and face four 5 inch holes at once.
We build also a six spindle machine for making three-part sections. See new catalog for description of 4 spindle radiator drill.

The Bickford Drill & Tool Co.
CINCINNATI, OHIO, U. S. A.

KEWANEE BOILER COMPANY
KEWANEE ILL.



MANUFACTURERS OF
HAXTUN STEEL BOILERS FOR HOT WATER AND STEAM HEATING



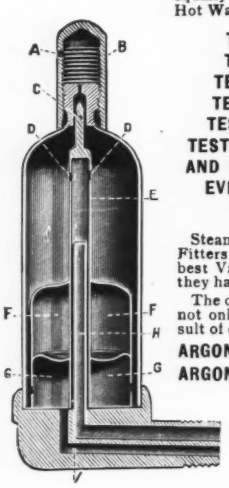
"TABASCO" WATER HEATERS
ALL STEEL SELF FEEDERS
SEND FOR SPECIAL CATALOGUES
169 LAKE ST.
·CHICAGO·

STANDS ALL TESTS
IN ORDER TO OBTAIN THE BEST RESULTS IN RADIATION IT IS NECESSARY TO USE

The Argon Automatic Air Valve

It is the only one on the market equally efficient on both Steam and Hot Water Radiators.

TESTED FOR AIR
TESTED FOR GAS
TESTED FOR STEAM
TESTED FOR WATER
TESTED FOR SERVICE
TESTED FOR PERFECTION
AND NOT FOUND WANTING
EVERY ORDER BRINGS
ITS DUPLICATE



Steam Heaters, Contractors and Fitters are not acquainted with the best Valve on the market, unless they have tried the ARGON.

The decision of experts, evinced not only in opinion, but as the result of experience, is that the

ARGON VALVES DO THE WORK
ARGON VALVES ARE RELIABLE

Need No Adjustment
Are Guaranteed

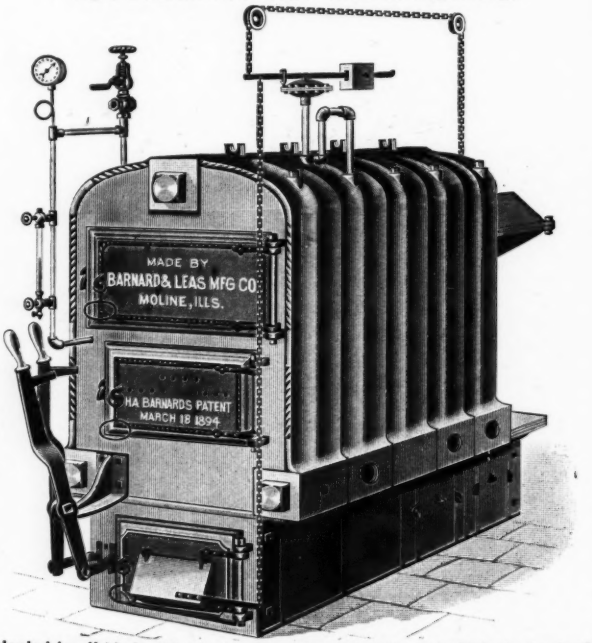
INTERIOR VIEW. EXTERIOR VIEW

WRITE FOR SAMPLE

The Argon Manufacturing Company
DENVER, COLORADO.

THE BARNARD BOILER

FOR STEAM AND HOT WATER HEATING.



Adapted to all kinds of fuel. Is economical, durable and efficient. Is simple and easy to operate. SEND FOR OUR NEW CATALOGUE.

BARNARD & LEAS MFG. COMPANY
MOLINE, ILLINOIS.

GEM Hot Water and Steam BOILERS

EASILY AND QUICKLY SET UP
CAPACITY GUARANTEED

WE ALSO MAKE THE

ABENDROTH VERTICAL SECTIONAL STEAM AND WATER BOILERS

LONG AND FAVORABLY KNOWN TO THE TRADE EVERYWHERE

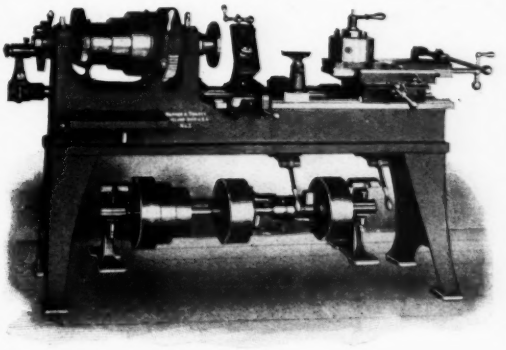
Write for Illustrated Catalogue

ABENDROTH BROS. 109-111 Beekman St., New York
114 High St., Boston, Mass.
Pt. Chester, W. Chester Co., N.Y.

AGENTS: Crane Co., Philadelphia, Pa. Western Valve Co., Chicago, Ill.

A COMPLETE LINE OF

Screw Machines and Turret Lathes
BRASS WORKING MACHINERY



UNIVERSAL TURRET LATHE
With Geared Friction Head, Compound Turret and Chasing Attachment

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WARNER & SWASEY
CLEVELAND, OHIO

MINUTES COUNT

When you have a "Rush" Job on hand 'tis then the virtues of

ARMSTRONG'S
WATER, STEAM AND GAS FITTERS TOOLS

make themselves apparent.

They are made especially for Time and Labor—Saving and for Extensive Wear.

PIPE THREADING and CUTTING OFF MACHINES
HAND or POWER
capacity from 1-4 in. to 6 in.

PIPE WRENCHES VISES
ADJUSTABLE STOCKS and DIES

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THE ARMSTRONG MFG CO
BRIDGEPORT, CONN., U.S.A.
NEW YORK 139 CENTRE ST.

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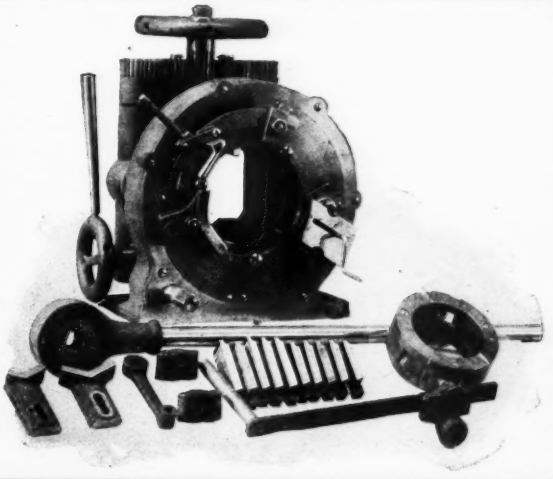

PORTABLE HAND PIPE THREADING AND CUTTING MACHINE

Has adjustable quick opening and closing die head. Can be set by graduation to any desired size. Can be released while in motion, closed instantly and positively. More rapid and accurate than any hand machine made. Gears completely enclosed from dust and chips.

Write for catalogue and prices.

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208 CURTIS ST., TOLEDO, O., U. S. A.
European Office: The Fairbanks Co., 16 Gt. Eastern St., London, E. C.

AUG. BUERKLE, PRESIDENT. JOS. A. LEIENDECKER, SECRETARY.

MONARCH WATER HEATER COMPANY

MANUFACTURERS OF

THE MONARCH INSTANTANEOUS AUTOMATIC WATER HEATERS

Address all Communications to the Company

306 Wood Street

Telephone 634 Court

PITTSBURG, PA., January 2d, 1901.

In view of the fact that the Ruud Manufacturing Company has seen fit to attack the position of the Monarch Water Heater Company in relation to its patents issued by the United States, on the strength of an English patent acquired by them and which was refused by the Monarch Water Heater Company five years ago. Notwithstanding it is fact beyond controversy that the Monarch Water Heater Company and its predecessors were the originators of the system of automatic, instantaneous water heating, manufacturing and selling many machines before any of its competitors of to-day ever thought of such a possibility. Beholding the Monarch, the temptation to imitate was at hand. Apparently lacking the genius to overcome the peerless automatic and gas burner of the Monarch Heater of to-day, it was necessary to cast about for some pretext to overcome it, and even where necessary, appropriate parts from the Monarch Heater to their own machines entire. The Monarch Company, relying alone upon the genius to be found within itself, refused the payment of any sum of money for anything so useless to its purpose as the English patent referred to.

The Monarch Heater Company requires no brains, British or otherwise, outside of itself, to bolster up the Monarch Heater. The estimation of the Monarch abroad can be measured by the fact that eight shipments to the Continent have already been made, and at the present moment an order for one hundred parts, representing one hundred Monarch Heaters when filled, will complete the last English order.

Surprising indeed, that those who have condemned in the most public manner a water valve of any kind, are now endeavoring to attach so poor a device to their loudly heralded, never failing acme of perfection. The Monarch Water Heater Company have already brought action in the U. S. Court against the Ruud Manufacturing Company and the Standard Heater Company, of Pittsburg, Pa.

We therefore notify each and every party purchasing or using any of the above heaters that we will use every legal means to protect every privilege granted us under the following Letters Patent:

583,275	granted	May	25th, 1896	601,436	granted	March	29th, 1898	632,212	granted	August	29th, 1899
583,276	"	May	25th, 1897	608,972	"	August	9th 1898	637,849	"	November	28th, 1899
584,326	"	June	15th, 1897	D29,584	"	November	1st, 1898	637,850	"	November	28th, 1899
591,538	"	October	12th, 1897	620 888	"	March	14th, 1890				

All parties purchasing or using a Monarch Automatic Instantaneous Water Heater will be fully protected.

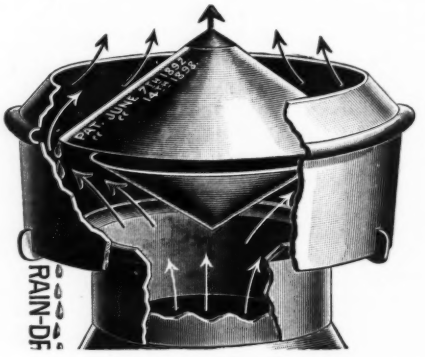
MONARCH WATER HEATER CO.,

AUG. BUERKLE, President.

"Pancoast" Ventilators

GREATEST EFFICIENCY AND LOWEST PRICES ARE OUR GREAT STRONG POINTS.

We have had the "PANCOAST" VENTILATORS in competition with other makes—in factories at the Cornell University and in thousands of cases of actual use—and the results have always been the same.



Sizes 2 in. to 10 ft.

THE "PANCOAST" WAS FOUND SUPERIOR TO ALL OTHERS, WITH PRICES ENTIRELY SATISFACTORY.

Write for model and catalogue.

National Pancoast Ventilator Company

Main Office: 223 & 225 S. 5th St., Philadelphia. Branch Offices: New York, Boston and Chicago.

Our New Heater

The Acme No. 15

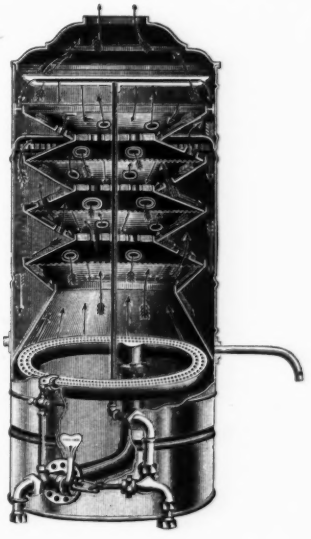
Will please your trade. It heats more water with a smaller Gas Consumption than any other Heater on the market.

It is 28 inches high and 12 inches in diameter

List price, nickel plated,

$20

IT HAS A LARGER HEATING SURFACE CONSIDERING ITS SIZE, THAN ANY OTHER HEATER ON THE MARKET.



There are other new features that will interest you. For information about them and discounts, address

THE MAKERS OF THE

Douglas, Acme and Flush Heaters

The Instantaneous Water Heating Co.

OHIO AND ORLEANS STREETS

CHICAGO

THE EAGLE

THE EAGLE NO. 3.

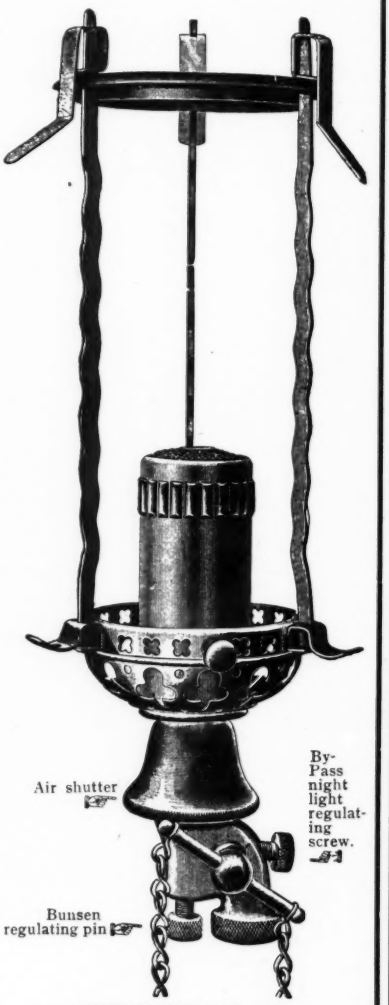
THE EAGLE NO. 5.

INSTANTANEOUS WATER HEATERS INCANDESCENT GAS BURNERS

Will prove themselves the favorites for 1901.

The Interlocking Valves with Safety Pilot Light, as fitted to all Eagle Heaters, insures safety in using. The only make Heater in the world wherein all parts are interchangeable.

A By-pass Burner for Incandescent Gas Lighting that readily adapts itself to the varying conditions. It is the kind that where one is tried others follow. Good light, non-clogging, easily adjusted, and the new feature of a night light, these are the virtues that are winging the Eagle to the top.



THE EAGLE NO. 47.

MANUFACTURED BY

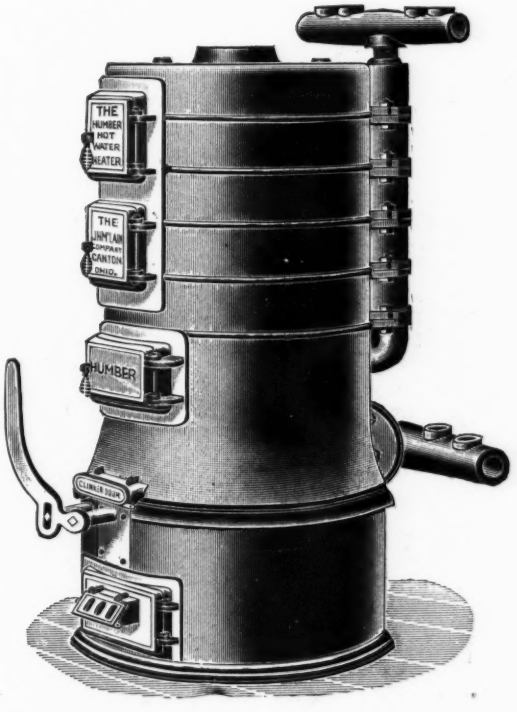
The S. Bernstein Co.

82-86 WEST BROADWAY, NEW YORK

The J. H. McLain Company

MANUFACTURERS OF

Hot Water and Steam Boilers



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Radiators Valves Pipe and Fittings

AND ALL MATERIAL USED IN THE CONSTRUCTION OF HOT WATER OR STEAM PLANTS

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The J. H. McLain Co.

CANTON, OHIO

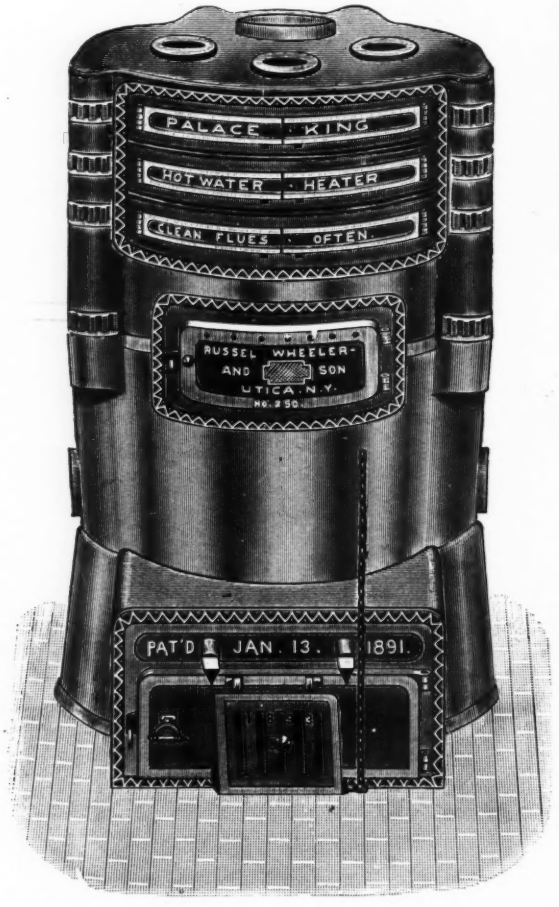
"The KING can do no wrong"—

By a strange co-incidence

THE PALACE KING
HOT WATER HEATER

is always in shape for satisfactory work.

The inclined water ways insure a rapid and un-impeded circulation.



What more is to be said? Doesn't the whole subject, after all, resolve itself into a question of **Circulation?**

The Palace King is built for business.

INTERNATIONAL HEATER COMPANY

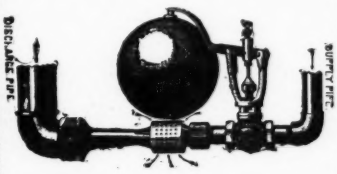
LARGEST MAKERS OF HEATERS IN THE WORLD

BOSTON NEW YORK CHICAGO DENVER

March 1st, 1901, Price List shows some interesting changes—write us.

Automatic **BRAENDER'S CELLAR DRAINERS**

Operated by Water or Steam Pressure.



It is the Best, therefore the Cheapest

It is used in Municipal and U. S. Government Departments, endorsed by leading sanitary experts, and is guaranteed to do all that is claimed for it. Write for circulars and testimonials.

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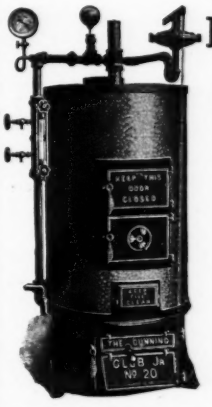
Sold to the Trade Only **PHILIP BRAENDER** 47 W. 125TH ST. NEW YORK.



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THE OLD RELIABLE

A NEW TYPE FOR SMALL HOUSES.

THE CLUB JUNIOR

	STEAM	HOT WATER
No. 15	175 ft.	275 ft.
No. 20	200 ft.	325 ft.
No. 30	250 ft.	425 ft.
No. 40	300 ft.	525 ft.

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GENEVA, N. Y., U.S.A.

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WILKS

HOT WATER HEATERS AND STEAM GENERATORS

Best in Use ::::: All Steel ::::: No Coils "Flues" No Cast Iron Sections :::::: Send for Catalogue

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NEW YORK OFFICE,
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KENNEDY GLOBE VALVE

WITH RENEWABLE DISCS

Never leak :: Always reliable

Are extra heavy, made of best steam metal. UNUSUALLY LARGE OPENING for passage of steam or fluid.

PERFECTLY TIGHT UNDER ALL PRESSURES OF STEAM, OIL OR GAS

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The Kennedy Valve Mnfg. Co.

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Works: Coxsackie, N.Y. NEW YORK

NOTHING but a QUICK OPENING VALVE will do some places

The Vincent

can be locked immediately. It also has the adjustable wedge. If your jobber does not keep them, write us.

Sweet & Doyle

Cohoes, N. Y.

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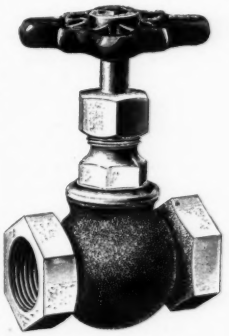

...USE...

K. & M. Valves

HIGH-GRADE WORKMANSHIP
PACKED STEMS
GENUINE STEAM METAL
THOROUGHLY TESTED

Sold from Standard Lists.

KINSEY & MAHLER CO., - PEORIA, ILL.

A Union forever

Is the

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Best in the World

Bronze Ball Seats
Ground Joint
Mal. Iron Ends and Nut

Manufactured by

E. M. DART MFG. CO.

Providence, Rhode Island

Just Ask About It

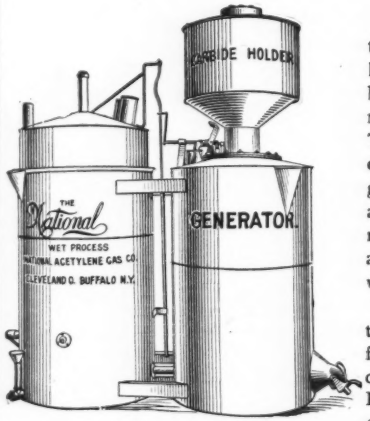
One End Water Connection.

Saves extension of pipe to further end of hot water radiators. Makes better, cheaper and neater work. Get new catalog of this new thing.

American Plumbers Supply Co.

76-80 Pratt Street, Chicago.

The New National



The only machine on the market which can be loaded with enough carbide to run 30 days or more without recharging. The only machine which does not produce after-generation when lights are turned off. The only machine which does not allow the gas to escape while recharging.

The carbide is fed into the water in a granulated form, thereby insuring cool, pure gas at all times. By our process of purification we are enabled to use Acetylene gas for cooking and running gas engines. The new National is fully approved by all the Boards of Fire Underwriters throughout the United States. **Local and General Agents Wanted**

Boston National Acetylene Gas Co.

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The Champion

Water Filters

ARE

Germ Proof and Give Perfect Satisfaction

MADE IN

FIVE STYLES AND FOURTEEN SIZES.

Secure a profitable Agency.

Catalogue and Prices upon application.

THE

Champion Safety Lock Co.

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COLT TRADE MARK.

CARBIDE FEED ACETYLENE GAS GENERATORS

Indorsed by the United States Government. The Department of Agriculture of the State of Pennsylvania says: "Safer than the usual employment of petroleum."

Entirely new principles involved. Made of the best materials, by the most expert mechanics. Guaranteed by the largest and most experienced concern in the business.

The COLT TRADE MARK Generators, are lower in price, more economical, and more easily installed and operated than any other make, and occupy one-quarter of the space.

No waste of gas; no heating. This is not true of other makes.

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108 FULTON ST. NEW YORK, N. Y.

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ACETYLENE GAS FIXTURES AND BURNERS

MANUFACTURERS OF

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FIXTURES,

1606 Chestnut Street, Philadelphia.

High Grade Thorium

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27 Park Place New York

Extra Brilliant **Bronze Powders**

IN GOLD, ALUMINUM AND ALL COLORS.

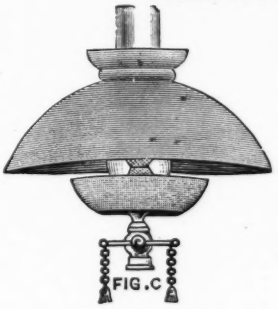
Send for samples and prices to

J. MARSCHING & CO.

27 Park Place New York

The Niagara Gas Burner

GIVES A FLOOD OF LIGHT



Soft, Mellow and Radiant, as from a Rochester Lamp. No ghastly glare and no renewals.....Nothing to wear out, burn out, or break...Send for particulars, or better still, a sample burner.....Sent for

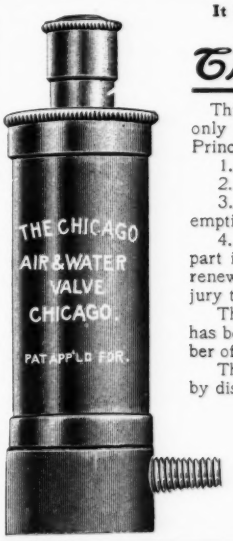
$1.25

THE ROCHESTER LAMP CO.

38 Park Place and 33 Barclay St.

NEW YORK

It is not only the name but the valve!



The "CHICAGO"

This Steam Radiator Air and Water Valve is the only valve that has the four correct Mechanical Principles of Perfection.

1. It will free radiators and coils from all air.
2. It absolutely prevents all water leakages.
3. The air chamber and separate partition empties valve from water and it will not water-log.
4. Durability of valve is assured, as expansion part is protected from injury and can be readily renewed at slight cost, while with other valves injury to expansion part destroys valve.

This valve is entirely automatic in action and has been severly tested, having been in use a number of years and giving perfect satisfaction.

The several features of this valve are protected by distinct patents. Other patents pending.

None Genuine Unless the Name "CHICAGO" is Stamped thereon.

Chicago Air & Water Valve Co.

31-33 South Canal Street

Chicago, Ill.

Coming Heat of Twentieth Century

The Jas. A. Trane System of Vacuum Heating has all the advantages of Hot Water Heating with none of its objectionable features.
Will heat a building with from 25 to 50 per cent less fuel than a Hot Water System.
Is absolutely noiseless in operation.
In case of breakage not one drop of water will escape from the system.
Such a thing as an explosion is an utter impossibility.

The Jas. A. Trane Vacuum System of Heating.

201-203 South Fifth Street, La Crosse, Wis.

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AND THIS

FOUNTAIN BEER COOLER

pays very good profit. It can always be sold to saloons newly installed and old tin coils, nasty and unhealthy, can be replaced by it. It is porcelain enameled inside and out, and is perfectly adapted to draw cool, clean and fresh beer.

THE SEITZ BEER COOLER MANUFACTURING CO.

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Eagle Stills Sell Well

They look well, work well, wear well—better than others that cost more and do less. Sanitary. Self-purifying. Automatic. Simple. Three parts—retort, distillate reservoir and condensing dome. Skeleton pattern handles. Nickel-plated faucets. 9 inches high, 15 in. diameter.

TWO STYLES.

No. 9. Best Rolled Sheet Steel, heavily coated idside and outside with pure block tin, weight 3¼ pounds—$5 retail.

No. 11. Best Hard Rolled Solid Sheet Copper, pure block tin lining, weight 6 pounds—$8 retail.

Liberal Profit for Plumbers. Write

Health & Comfort Supply Mfg. Company

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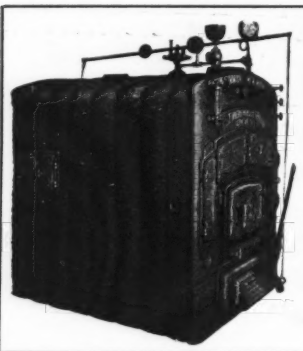

HAVE YOU SEEN
The **Furman**
New Model **Boiler**
For Steam or Hot Water (Interchangeable)

Sectional—Self Contained—Surface Burning—19 sizes—Capacities 350 to 4000 sq. ft.—Any size can readily be enlarged—Let us send you Free our new Catalogue and Fitter's Hand Book of valuable information for Practical Fitters. **Write for them to-day.**

The **Herendeen Mfg. Co.** Dept. D.
Geneva, New York
Branches: New York, Boston, Bloomington, Ill.
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HADESTY IMPROVED TAPPING MACHINE

For tapping water and gas mains against pressure. It leads them all. Sold on approval. Taps mains from 3 to 30 inches. No saddles required for different sized mains. Weight, complete, only 18 lbs. A boy 12 years old can make a connection in 15 minutes. Get prices from

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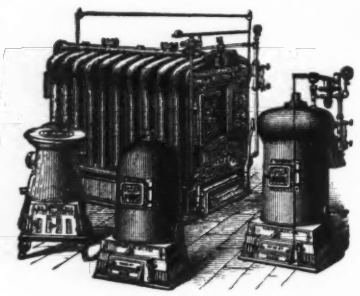

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GOLD MEDAL PARIS EXPOSITION HIGHEST AWARD

THE MOST COMPLETE LINE UNDER ONE NAME MADE IN THE UNITED STATES

OUR CAPACITIES RANGE IN
Square feet of Water Radiation 100 to 6,000
Square feet of Steam Radiation 200 to 3,600

Send for catalogue Correspondence solicited

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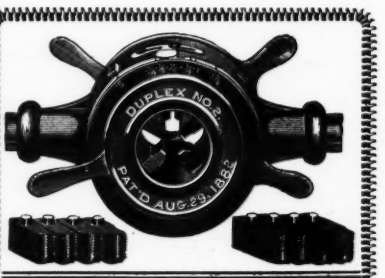

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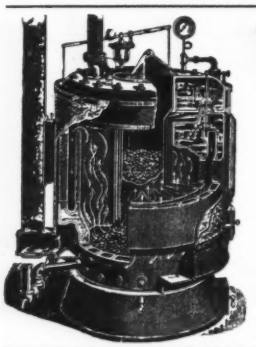
DUPLEX ADJUSTABLE STOCKS and DIES should be in the hands of every PLUMBER AND PIPE FITTER. DO YOU OWN ONE? Let us mail you list and quote prices : : : : :

THE HART MFG. CO.
No. 19 Wood Street Cleveland, Ohio



YOU KNOW

How coal is wasted up a flue. We guarantee the **"ROBERTS"** to be the most economical and easily managed boiler on the market. Will not such a boiler get you further orders?

Philadelphia Office:
Builders' Exchange,
18 South 7th Street

Roberts Machine Company
Collegeville, Pa.

WORDS OF WISDOM

"Do not advertise and stop,
But advertise and stay,
For those who read your ad last week,
Will look for it to-day."

DIXON'S GRAPHITE COMPOUND

Is infinitely better than red or white lead for making steam, gas or water pipe joints. Joints will be tighter, and can be broken months or years after without damage to pipes or tools. **IT WILL PAY EVERY PIPEFITTER TO SEND FOR SAMPLE AND CIRCULAR.**

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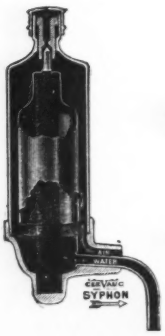

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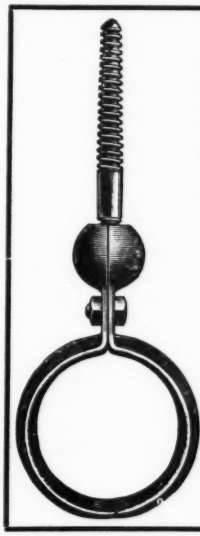

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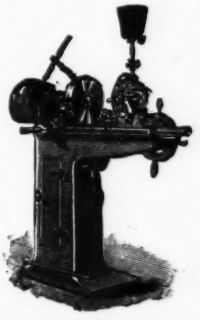

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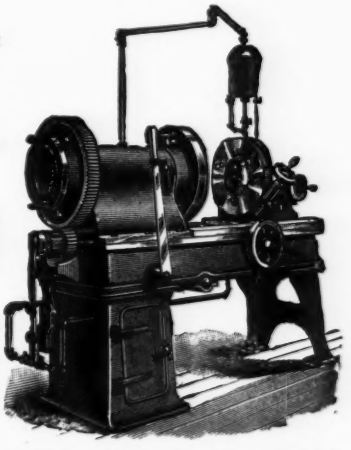

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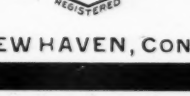

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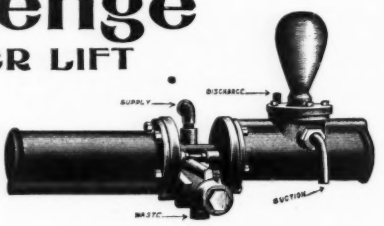

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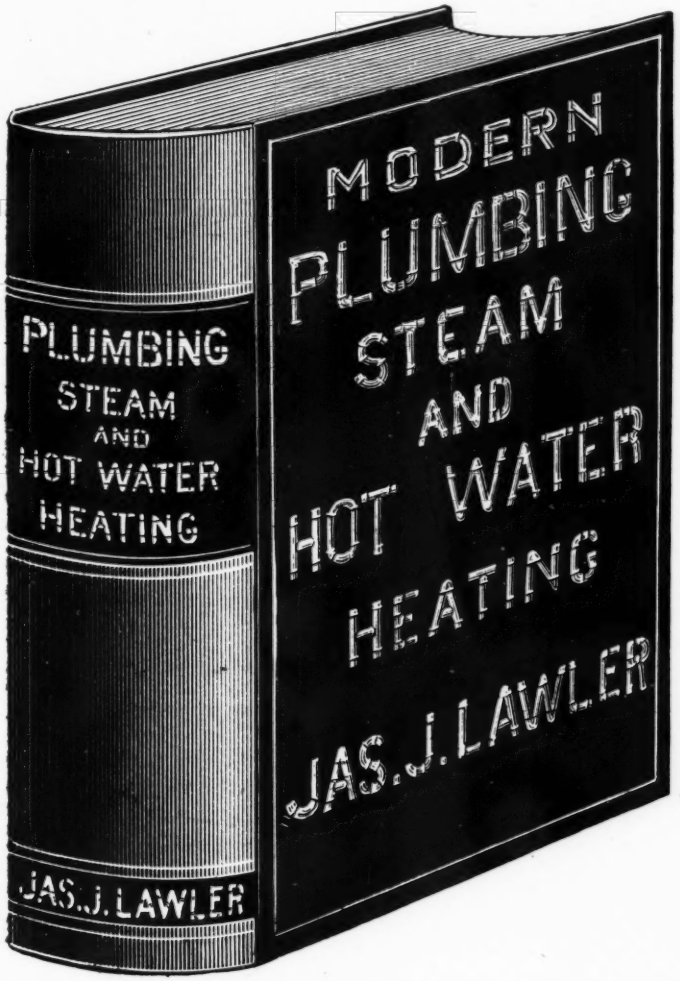

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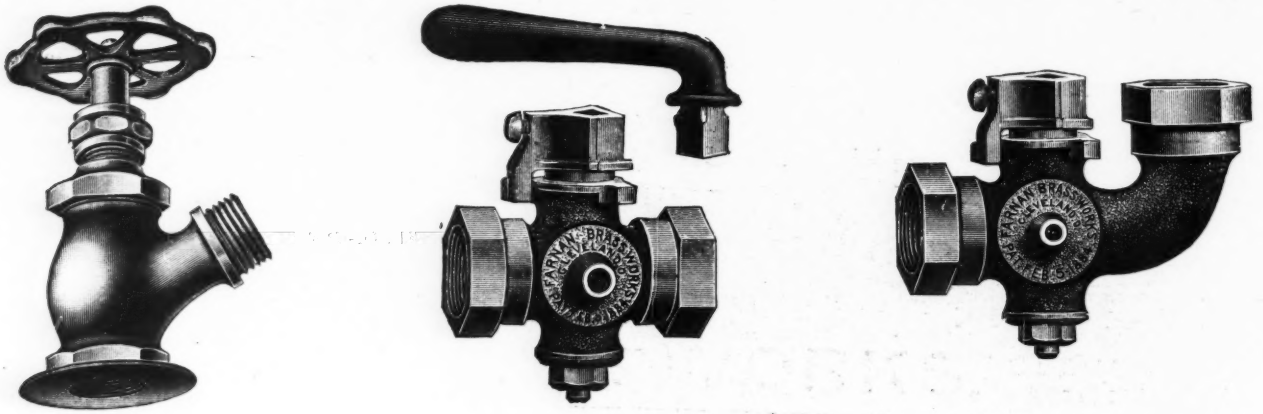

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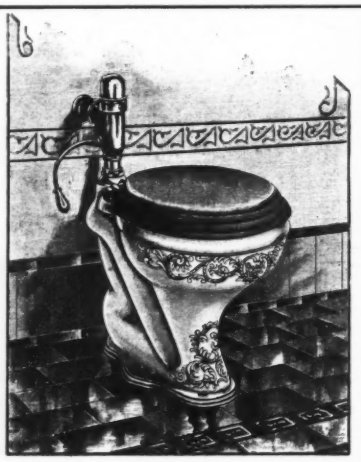

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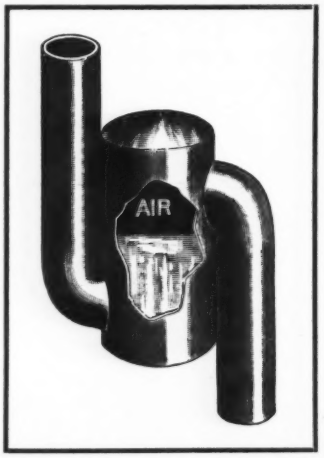

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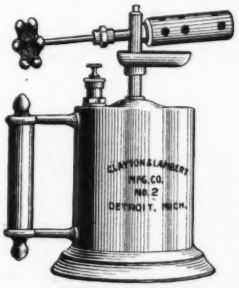

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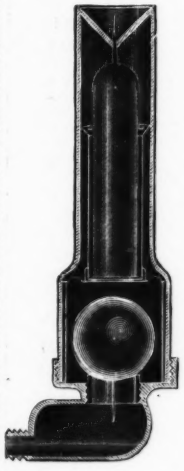

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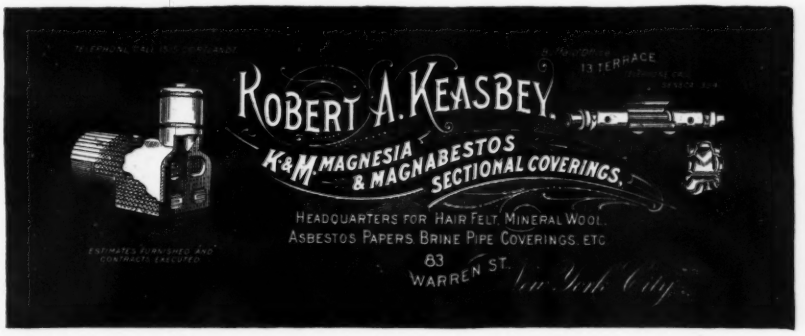
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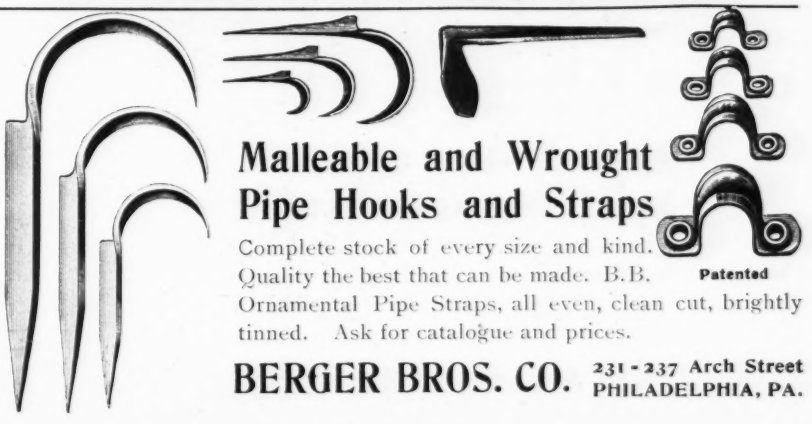

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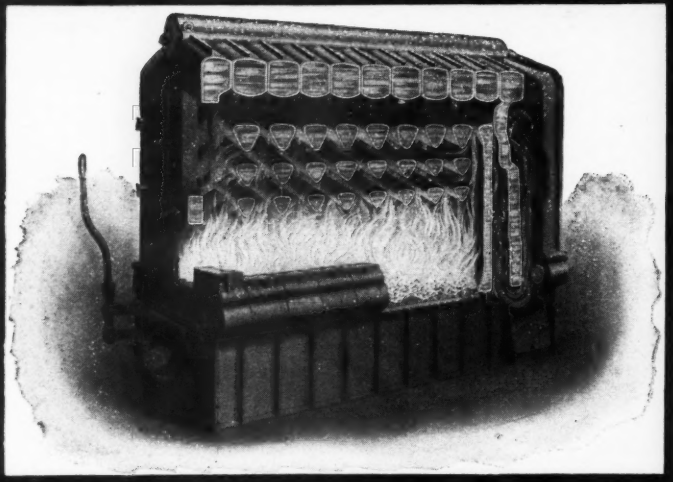

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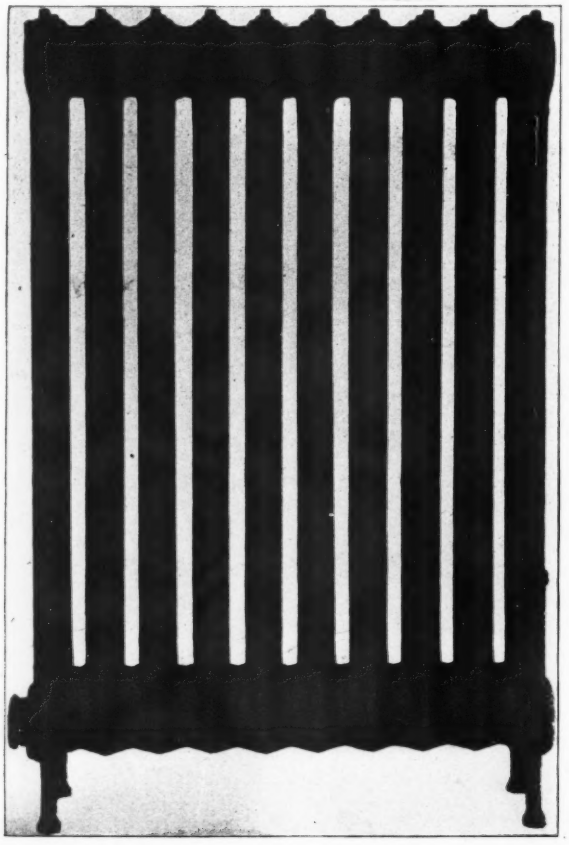

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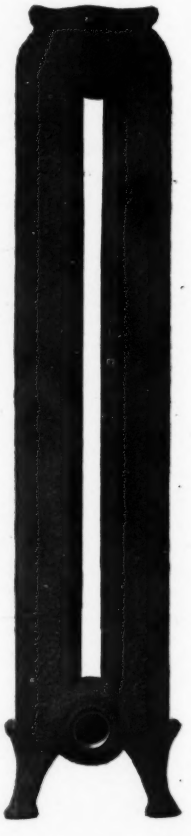

DOMESTIC ENGINEERING

Plumbing : Heating : Lighting :: Ventilating

Whole No. 137 *MARCH FIFTEENTH, NINETEEN HUNDRED AND ONE* *Vol. 20, No. 6*

Plumbing and Household Sanitation—VIII.

A Course of Lectures which, when completed, will cover the theory and practice of the art

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Trap Ventilating.

Trap Testing Apparatus used to Illustrate these Lectures

The trap vent pipe was, as I have said, originally supposed to afford a reliable cure for siphonage, and under that supposition the trap-vent law was made, and is in operation in the majority of cities and towns which have any plumbing laws at all.

For the purpose of testing the efficiency of the trap vent when it is new and clean and therefore at its best Mr. Hubbard has had the apparatus erected which you see in Fig. 59. The cut shows you the entire apparatus, including the parts not visible to you in the

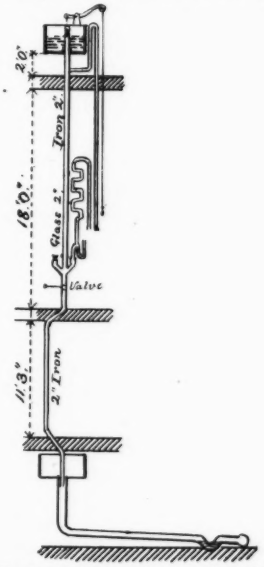


Fig 59. Apparatus for Trap Testing erected at the North End Union for this Course of Lectures.

room. On the floor of the attic space above this lecture hall is our large supply tank, having a capacity up to the overflow of 40 gallons of water. From the bottom of this tank descends the 2-inch iron and glass pipe which you see, with two branches at a height of three feet from the floor for taking the traps to be tested. The piece of glass pipe is 4 feet long and has been inserted in order to enable you to follow the course of the water and study the manner in which air mixes with it in its descent from the tank under varying conditions of the tank valve vent. The valve in the tank is a 2-inch standpipe valve, and the top part of the 2-inch waste from the tank is vented by an inch pipe, which you see on the right hand side, descending to within five feet of the floor and, for the present, corked up at the lower end. Below the trap branches is a throttle valve by means of which we shall be able to illustrate the effect of "back-pressure," as will hereafter be explained. Below the floor of this hall the 2-inch waste passes through the gymnasium below and discharges into a 25-gallon tank below the gymnasium floor, as shown.

The tank empties through a 3-inch pipe, which connects with the soil pipe at the basement floor, being trapped on its way with a 3-inch running trap.

Now we may suppose that our tank represents a bath tub and the 2-inch iron pipe its waste, and that in the story below two basin wastes enter this waste through the two trap branches which you see, and that our traps are intended to serve these two fixtures. So far we have conditions corresponding to those in actual practice with new work where the rooms are very high.

The siphoning action may, however, if we wish, be made considerably more severe than is found in ordinary practice by corking up the top of this standpipe valve of our tank, which corresponds with the standpipe outlet valve of a bath tub, and also corking up the vent pipe coming from the top of the 2-inch tank waste, so that no air can enter the waste except through the fixture traps to be tested. Though in practice it often happens that house owners will close up the overflow outlets of their fixtures in the fear of "sewer gas" with corks and putty; and snow and frost will frequently close up the vent opening.

In order to represent "back-vent" piping we have here also some speaking tubing and bends, which we shall apply to the crowns of the traps to be tested and by this means investigate the effect of friction in retarding the action of this back airing.

By means of this apparatus we shall be able to determine (1) whether or not seals of traps in common use can be broken even when newly and fully vented and in accordance with the law, under conditions which can be and frequently are encountered in plumbing practice; (2) what

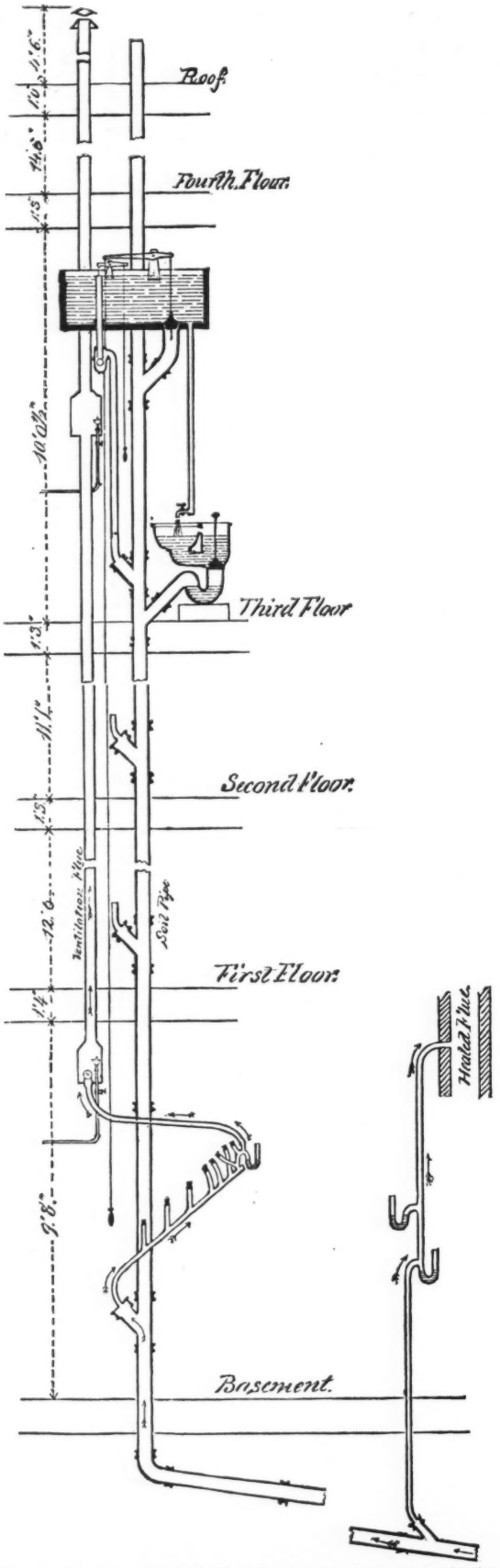


Fig. 60. Apparatus used in the Experiments made by the Author for the Boston City Board of Health.

effect corrosion, incrustation and various forms of clogging in the pipes have upon the trap seals; (3) the relative power of various forms of traps in resisting siphonage, and (4) whether any form is capable of resisting the severest possible siphoning action that can be encountered in plumbing practice.

Apparatus used in the Experiments made for the Boston City Board of Health.

Before, however, making our experiments with this apparatus, which will require gas light, we will complete our lantern slide work, comparing our plant with those used in my previous experiments for the Boston City Board of Health and at the Massachusetts Institute of Technology and elsewhere, pictures of which will be shown on the next two slides.

This cut (Fig. 60) shows the Board of Health apparatus. It is composed of ordinary piping erected exactly as it is in regular practice in house plumbing. A vertical stack of 4-inch soil pipe was erected without bends from the outlet above the roof to the horizontal run under the basement floor, a distance of 70 feet 9 inches. The soil pipe was run up straight in this manner in order to furnish the conditions for the severest possible tests for siphonage and back pressure. At the same time it formed the arrangement most commonly met with in practice. The unbroken fall of the water through such a pipe evidently creates the most powerful compression of the air in advance of it and the greatest rarification behind it.

Just below the fourth floor was placed a large cistern 44 inches long by 16 inches wide and 15 inches high up to the overflow, inside measure; or of 46 gallons capacity, as against 40 gallons capacity, which we have here. The cistern served to illustrate the action of a bath tub, by having a 1½-inch discharge pipe at its bottom trapped with a Bower's large sized trap, and entering the soil pipe just above the entrance of the water-closet waste. The water-closet used was one of Zane's plunger closets, at that time popular. To expedite its filling a large service pipe from the cistern was used, and the water was allowed to fill the closet through a brass compression-cock. The water-closet was supplied with a regular overflow pipe so that, when full, its capacity was always the same, i. e., 4½ gallons. The plunger of this closet having no overflow, its operation produced as powerful a siphoning action as is possible with any plumbing fixture, and indeed the use of plunger closets is partly for this reason gradually diminishing everywhere.

To test the effect on traps below of emptying the tank after the manner of a flush tank, a 4-inch outlet valve and waste pipe were fitted up in the manner shown.

Outlets were left on each story below the water-closet for testing the traps at various heights on the stack. The soil-pipe was ventilated at the top full size, and had the usual foot vent. Back pressure was generated by the bend just below the basement floor.

In order to permit also of a series of experiments on evaporation a 4-inch galvanized iron flue was erected by the side of the soil-pipe. This flue terminated just below the first floor in a galvanized iron lantern, with a glass door on its front side. A 1½-inch rubber tube was con-

nected with the bottom of the lantern, and an anemometer was placed above the point of connection in an enlargement made to receive it. The anemometer was so arranged and placed that it could measure accurately the current of air passing through the rubber tube in either direction. The galvanized iron flue could be tested either cold or heated by gas-jets, as shown in the drawing. A second lantern was placed on the third floor with a similar appliance for heating the flue.

A 1½-inch lead waste-pipe was connected with the soil-pipe just above the basement floor. This branch waste had a number of ventilating openings made upon it, and a deep seal S trap at its end. The trap had three ventilating openings in its outlet arm, one at the crown and the others below the crown, as shown. All the vent openings both on the trap and on the branch waste were provided with small connecting tubes, so arranged that the rubber ventilating flue could be readily attached to either. The openings were, furthermore, all provided with closely fitting corks so that they could be hermetically sealed.

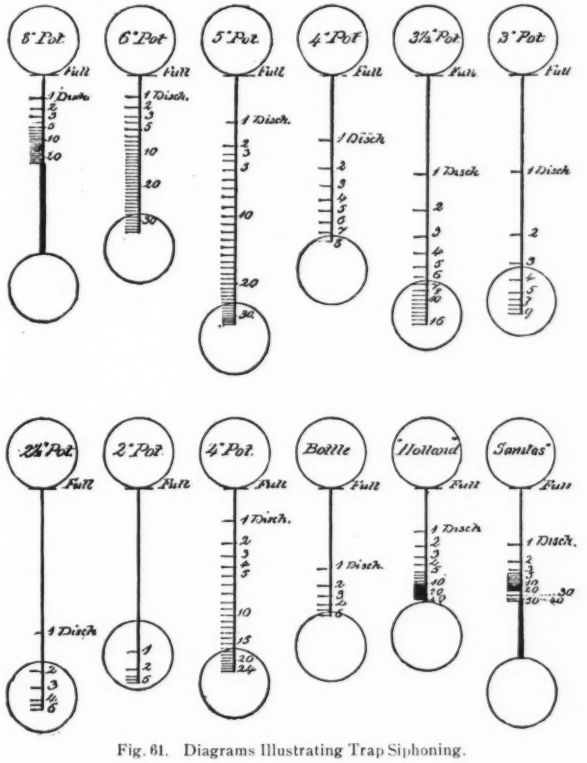


Fig. 61. Diagrams Illustrating Trap Siphoning.

Simpler Form of Apparatus used by the Author.

By this arrangement the effect of ventilation at different points of the trap or its waste-pipe upon its water seal could be accurately tested. Further tests in evaporation were made by connecting a second branch waste below the first with a brick flue heated by a stove.

In order to make an accurate record of these experiments the diagrams shown in Fig. 61 were made. In these the trap seal is represented by a vertical line between two circles. The upper circle represents the outlet arm of the trap in section, and the lower circle the inlet arm. The horizontal lines show the level of the seal after each discharge.

The small diagram (Fig. 62) illustrates a simpler form of apparatus upon which I made a large number of experiments on siphonage. I assumed that as severe a test for siphonage to which a trap could be subjected in

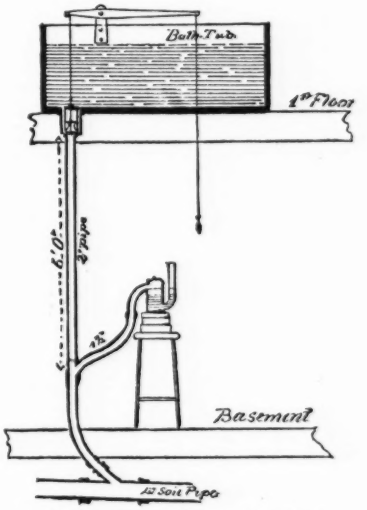


Fig. 62. Simple Appapatus for Trap Testing.

practice would be that which would be sufficient to siphon out an 8-inch pot trap or a ventilated S-trap constructed in the usual manner. Such a test may be made by connecting the trap with a 2-inch waste-pipe from a large bath-tub, emptied through an outlet large enough to fill the waste-pipe full-bore, the waste plug being successively raised and lowered a number of times while the water is escaping. The siphoning action produced on a 1½-inch branch connected with such a waste at a point six feet below the tub is sufficient to destroy in one second the seal of a 1¼-inch S-trap of the ordinary construction, having a vent opening at the crown, of the same size with the base of the trap (1¼ inches), and connected with a 1¼-inch ventilating pipe of smooth, new lead, sixteen feet long. It will also destroy the seal of an ordinary S-trap having a vent-opening at the crown ¾ inches in diameter, without any vent-pipe attached thereto, and it will siphon out a pot trap 8 inches in diameter having a seal four inches deep.

The tank in this little apparatus, which in principle resembles ours here, had a capacity of 100 gallons. The waste-pipe was 2 inches in inside diameter like ours, but only 6 feet long to the trap branch, while ours is 17 feet long to the testing branches.

The outlet plug, like ours, was large enough to fill the waste-pipe full-bore.

The diagrams shown in Fig. 63, represent by horizontal lines, on the same principle with those above, already described, the amount the seal was lowered by each discharge.

The next figure (64) gives the sections of seven of the traps tested, the horizontal lines corresponding with those in the diagrams. Each test was repeated a number of times, the results being each time almost absolutely identical. A single discharge of 15 gallons destroyed the seal of a 1¼-inch S-trap vented with a 1¼-inch pipe 25 feet long, attached at the crown. With this vent-pipe shortened to

15 feet two discharges of 15 gallons each broke the seal. Shortened to 9 feet 7 discharges broke the seal.

In the pot trap tests 15 gallons were used at each discharge. They all lost their seals, as shown, except the

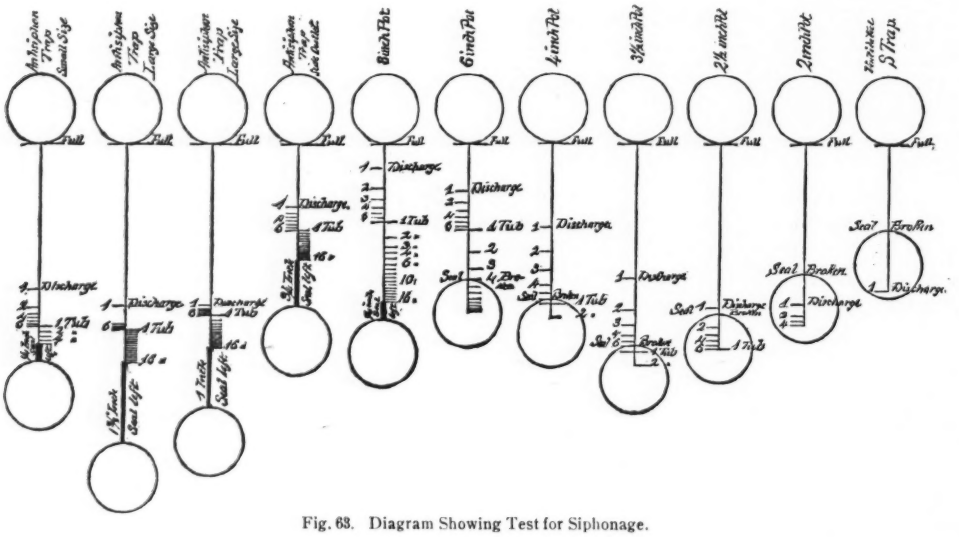


Fig. 63. Diagram Showing Test for Siphonage.

8-inch pot, which lost all but a quarter of an inch of its $3\frac{1}{4}$-inch deep seal after the tank had been emptied 16 times.

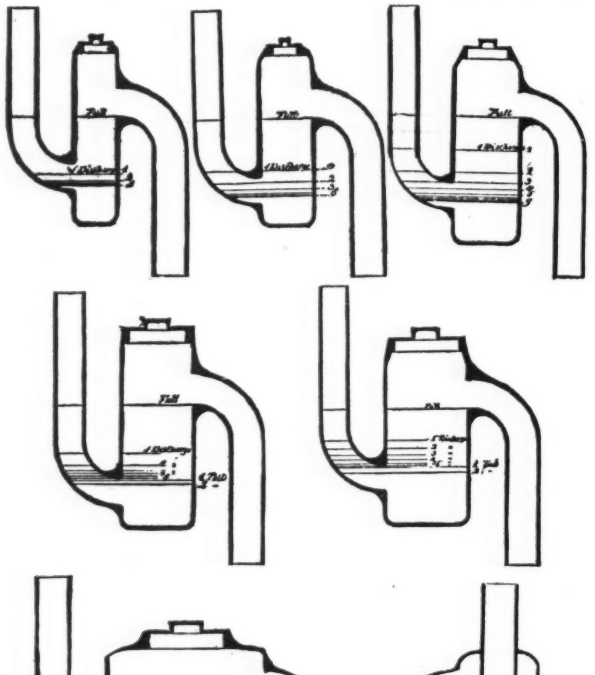


Fig. 64. Tests for Siphonage on Pot Traps of different sizes.

The 6-inch pot required four and the 4-inch pot two tanks full to break their seal.

The next figure (65) shows sectional drawings of the different sizes of pot or cesspool traps tested on the Board of Health apparatus, and also several other traps tested at the same time with the pot traps, but as only two were able to preserve their seals against the tests applied, and as most of them had already been tested in the experiments made for the National Board of Health and their tests published, by which their power of resistance as compared with that of a ventilated S-trap and to a pot trap, was made known, it was thought unnecessary to record the failures here.

The tests for siphonage were made on pot traps unventilated and on ventilated S-traps, the traps being placed on the Y branch outlet on the second floor at a distance of about 11 feet below the bottom of the water-closet trap, since at this point the siphonage proved to be most severe. The tests were made with the closet alone, and also with the closet and bath-tub combined.

The result of the experiments was that the discharge of the water-closet was sufficient to unseal the S-trap even though it was ventilated at or below the crown in the manner prescribed by the plumbing regulations with vent pipes of the full size of the trap. It made no material difference as to siphonage whether the vent-pipe be applied immediately at the crown or at a considerable distance below it. Had the pipes been partially clogged by sediment or rust the results would, of course, have been even more serious.

An unventilated S-trap was, of course, completely siphoned out by a single discharge of the closet, leaving only a few drops of water in the bottom of the bend.

A $1\frac{1}{4}$-inch S-trap having a $1\frac{1}{4}$-inch vent hole in the crown, and a $1\frac{1}{4}$-inch pipe of smooth clean lead 17 feet long attached to the opening, had its seal broken in three discharges.

A $1\frac{1}{2}$-inch S-trap with $1\frac{1}{4}$-inch vent, constructed as shown in the slide, and having 7 feet of 1-inch pipe attached to one of the vent openings, the others being closed, lost its seal after 5 discharges. With a 17-foot vent-pipe

4 discharges sufficed. When the bath-tub discharge was added to that of the water closet a single discharge broke the seal with the 17-foot vent-pipe and swept nearly all the water out of the trap.

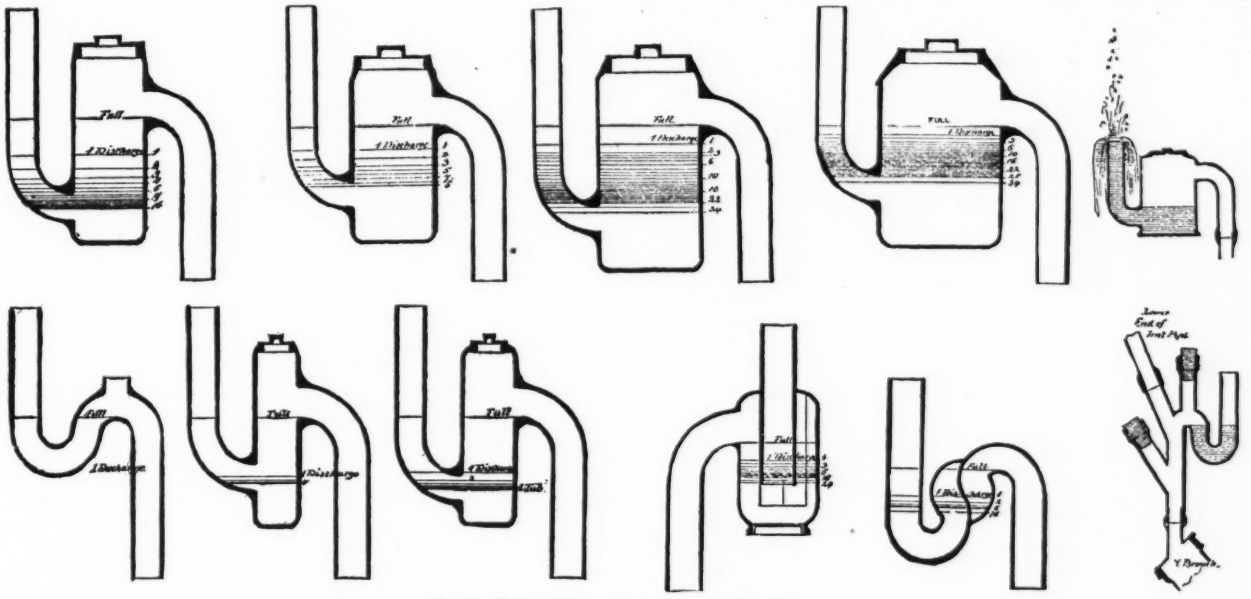


Fig. 65. Tests of Siphonage on Pot and other Traps.

Experiments on the Pot Traps.

The pot traps tested measured respectively 2 inches, 2½ inches, 3 inches, 3½ inches, 4 inches, 5 inches, 6 inches and 8 inches in diameter, and from these tests we found that their power of resistance to siphoning depends upon their size, and more particularly upon the diameter of the body, a half-inch excess of diameter affording a very considerable excess in depth of seal. With equal depth the resistance will be in direct proportion to the diameter. The 2-inch pot lost its seal in one discharge of the water closet, a 2½-inch pot in two discharges, a 3-inch in four discharges, a 3½-inch in seven discharges, a 4-inch in seven discharges, a 5-inch in 22 discharges, a 6-inch in 27 discharges and an 8-inch lost 1½ inches of its seal in 24 discharges, and would probably have resisted for several hundred discharges. In well arranged plumbing, however, a pot trap having a body 8 inches in diameter and having 1½-inch or 1¼-inch connections, may be considered perfectly safe so far as retaining its seal is concerned, so long as its seal is not contracted by deposits.

An examination of the sectional drawings of the pot traps will show at a glance the effect of each discharge on its water seal, the horizontal lines giving the exact level of the water after each discharge.

Apparatus used for the Experiments at the Massachusetts Institute of Technology.

The next figure (66) shows the apparatus erected at the Massachusetts Institute of Technology already referred to. It consisted of a stack of four-inch soil-pipe with two water-closets set ten feet above the wastes of the traps to be tested. The closets were a Zane and a Jennings, both quite popular at the time these experiments were made. The soil-pipe had a number of bends to exemplify the bends, more or less of which are usually required in any tall building. The vent-pipes are on the right and were of 2-inch cast iron pipe, also with bends. Openings were left in both stacks of pipe, as shown in the drawing, to permit of a great variety of experiments with long and short piping, and with from only 1 up to 8 on the soil-pipe stack, and from 1 to 13 on the trap-vent stack.

In this way the apparatus was made to correspond with that in any form of house we desire to imitate. Some of the tests were very severe, but no more so than often encountered in plumbing practice. If we are to be forced by the law to put our clients to the great expense and danger of ventilating every trap, we have the right to demand, first, that the means employed shall actually afford us the security it pretends to, and not fail at the first critical moment; and second, that no other simpler and better means exist for securing the desired result.

We found that the discharge of either or both closets instantly broke the seal of an unvented S-trap whether the soil-pipe were the full length or shortened to half its length by opening the middle plug. When the falling water in the soil-pipe produces the partial vacuum behind it as it descends, if the soil-pipe extension above it is short and closed at its top, the action is at its maximum because there is very little air to expand. If the pipe is short and open at the top it is at its minimum. If it is long and closed still the action is powerful, but if it is long and open above, a medium effect is produced, and this was the condition we had in these tests.

We next ventilated our S-trap with a vent-pipe the full size of the bore of the trap. Leaving the soil and vent-pipes full length, we found three discharges of the two closets was sufficient to destroy the seal. Thus we showed that with the long stack of pipe our ventilation signally failed. We next cut off half the bends and half the length of both soil and vent-pipe, leaving a medium length of each of forty-five feet of new pipe, and we found that four discharges of the two closets destroyed the seal.

In the next experiment we broke the seal with two discharges using a 1¼-inch vent pipe, and afterwards broke it with four discharges on shortening the vent to 15 feet. This gave a shorter vent-pipe than we should ever be likely to encounter in practice. Hence if the friction produced in this short length of pipe is enough to prevent the effectiveness of the vent, anything longer than this would have destroyed it still easier. This shows that our expensive venting is utterly untrustworthy. In the Boston Board of Health tests the same results were obtained by the discharge of a single plunger closet.

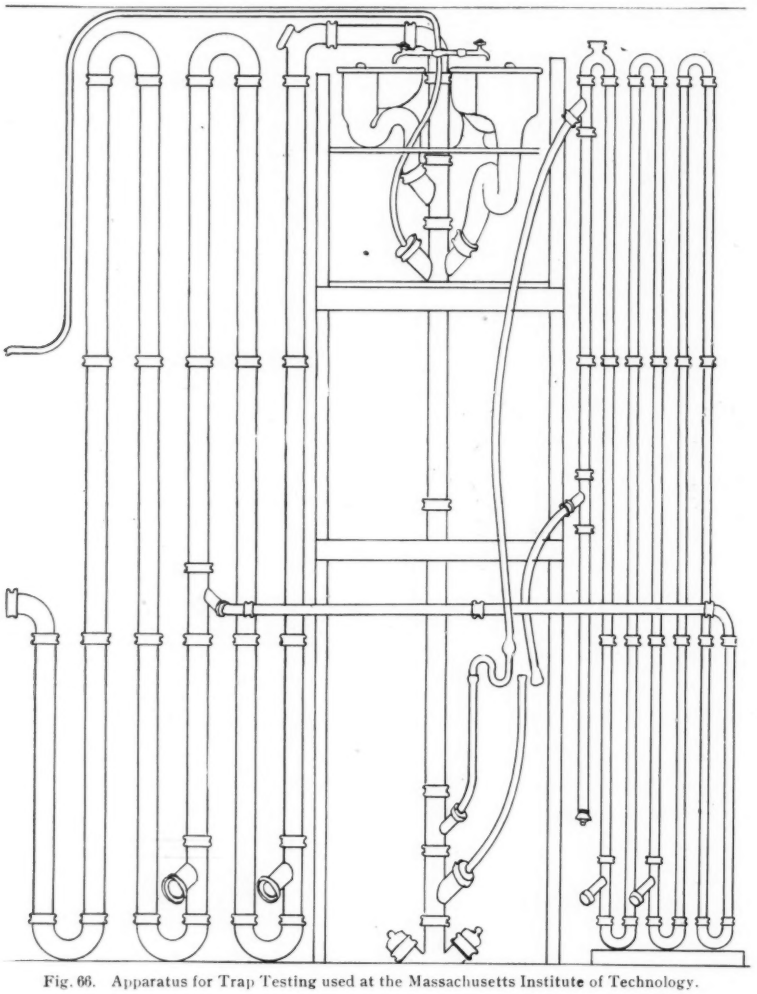


Fig. 66. Apparatus for Trap Testing used at the Massachusetts Institute of Technology.

The tests were made on a 2-inch by 4-inch Y. In our experiments for the City Board of Health we were severely criticized by "The Sanitary Engineer" for using a 4-inch by 4-inch Y branch, which we were told, would produce an action at least four times as powerful as the smaller branch. In order to test this point we connected our waste with the 4-inch by 4-inch branch shown immediately below the 4-inch by 2-inch branch and made preparation to repeat the last test under the new conditions. We cautioned the audience who were seated nearest the trap to hold firmly to their seats, which had been tightly screwed to the floor in order to prevent them from being sucked bodily into the drains by the prodigous siphoning power of the 4-inch by 4-inch branch claimed by "The Sanitary Engineer." On discharging the closets, however, we found no appreciable difference in the two Ys, and the gentlemen in the first row then confidently released their hold upon the furniture.

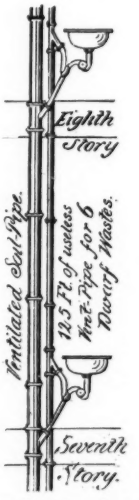


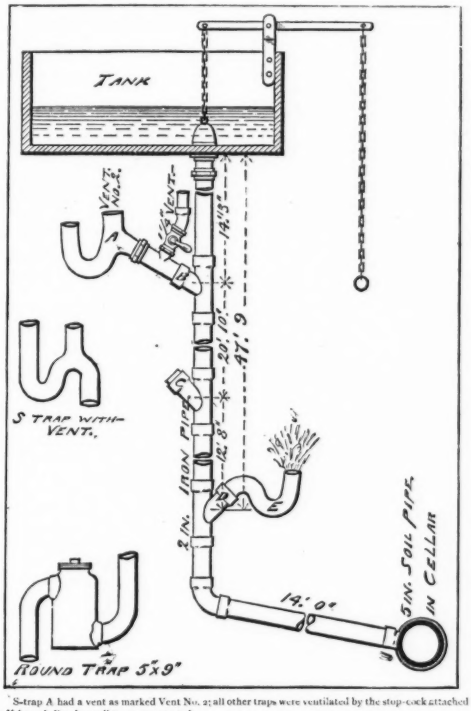
Fig. 67. Trap Vent Pipe 125 ft. long in a tall Apartment House.

When the mouth of the vent-pipe has become partially closed by the gradual deposit of sediment, the supply of

air through it is proportionally retarded, and it becomes less and less of a safeguard against siphonage. We had made a great many experiments in this field and found the resistance exactly proportioned to the size of the vent-pipe.

Uselessness of Trap Venting forcibly shown in the Case of a Tall Hotel.

The stack of pipes shown in Figure 67 shows a trap vent pipe 125 feet long in a tall apartment house, which in compliance with the building law I was obliged to specify. As you see by the drawing the lavatories are placed over one another in such a position that the distance from their traps to the main ventilated soil pipe is not over 18 or 20 inches. These short branch wastes were powerfully flushed at each usage of the fixtures by a stream of water filling them "full bore," and discharging at the rate of nearly half a gallon a second. Traps were specified which cannot by any possibility be siphoned out, nor even have their seals seriously lowered. No better illustration of the wastefulness of this requirement could be found. The owner in this case lost over a thousand dollars for the privilege of seriously endangering through evaporation, the water seal of every trap which is not kept constantly in use throughout the hotel.



S-trap A had a vent as marked Vent No. 2; all other traps were ventilated by the stop-cock attached to Y-branch B, where all traps were tested.

With Vent No. 2 open and stop-cock closed, it was not possible to remove any water from the S-trap, but with Vent No. 2 closed and stop-cock open, the seal of the trap was broken. S-trap with vent shows the form of trap which the committee recommends.

Trap E was placed on Y-branch D to show back pressure, but Y-branch D, as well as Y-branch C was closed during experiments on syphonage.

Fig. 68. Worcester Trap Tests.

The Celebrated "Worcester Tests.

Fig. 68 shows the apparatus used in the Worcester experiments,* and Fig. 69 is an illustration of some of the dangers incurred by the use of the trap vent-pipe.

The master plumbers of Worcester made some tests on the apparatus shown here. The S-trap shown on the highest branch was tested for siphonage, and its seal broken when ventilated through the $1\frac{1}{4}$-inch vent next the soil pipe, the vent No. 2 being closed.

*See appendix for full description of the Worcester tests.

This cut (Fig. 69) was used to illustrate a paper on trap ventilation I read before the Boston Society of Architects in 1891. The top of the vent-pipe is shown clogged up by frost. One of the basin trap vents is trapped by a

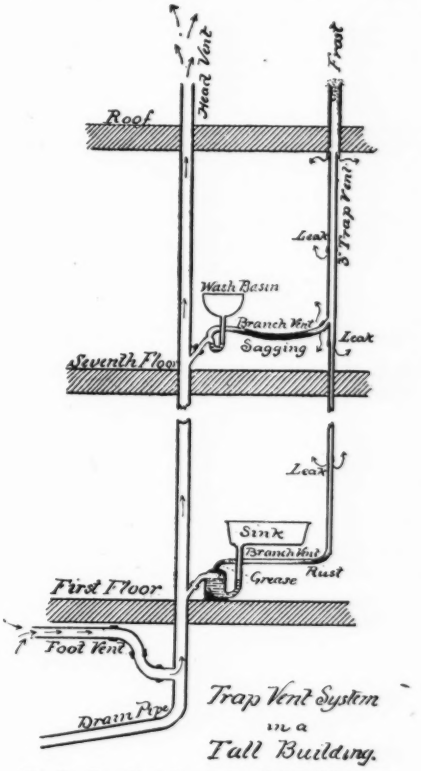


Fig. 69. Trap Vent System in a Tall Building.

sag in the pipe, and the mouth of the sink trap-vent is clogged by grease. Another deposit occurs in the bend of the vent stack where flakes of rust have fallen from the iron of which the stack is made. A number of joints have sprung leaks. All these defects are common in plumbing and are brought together to remind the house owner that the luxury of complication in plumbing cannot be enjoyed without its risks. A prominent member of the Plumbers' Association has had for a long time in his shop on exhibition a back vent pipe completely filled solid for several inches from its mouth with filth deposited by fatty vapors and greasy water in the waste pipes. It is sometimes urged that these deposits of grease, frost, etc., can from time to time be removed. This is true; but in practice, as a rule, they are not removed, partly because they are usually inconvenient of access and partly because the presence of the danger is seldom announced to the house owner until long after the mischief has been done. A device which requires more watching itself than the thing it is designed to protect is worse than no device at all, because it affords a false sense of security, and leads to the use of traps which possess no power themselves to protect when the back vent pipe fails.

The result of the reading of this paper was a unanimous vote on the part of the Boston Society of Architects to forward to the proper city authorities a recommendation to repeal the back vent law. A committee was appointed

and counsel employed to attend to the matter. The efforts of the society, however, in this direction have never met with success, and they have not ascertained with entire certainty from what source the opposition came.

The next two cuts present a few illustrations of unnecessary complication in plumbing. The first (Fig. 70) shows the piping of a slop sink in a house lately built on Fifth avenue, New York. The sink forms one of four built over each other in successive stories, and all the pipes shown

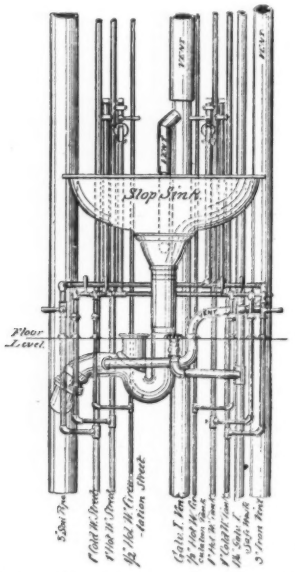


Fig. 70. Complicated Piping in a House on 5th Ave., N. Y.

in the drawing are built for their service. Each sink is vented just below its strainer into a large galvanized iron ventilating flue. The trap is vented into a 3-inch cast iron flue. A lead safe is used under the sink at the floor and connects with a 1¼-inch iron pipe leading to the cellar. So much for a slop sink.

No expense has been spared to render the mechanical part of this job perfect, and it is, in fact, a very beautiful piece of workmanship. Yet it is not good plumbing. In the first place the trap seal is trebly besieged for evaporation. In the second place no proper means of flushing

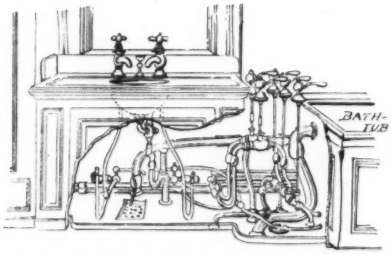


Fig. 71. Complicated Plumbing in another New York Residence.

the apparatus has been provided. In the third place the outlet and trap vent pipes, which both enter cold flues, are worse than useless. In the fourth place the safe and its waste pipe are superfluous; and in the fifth place the whole fixture is an unnecessary nuisance in a private house. Even where a proper flushing rim is provided for slop-hoppers servants will not make proper use of it, and the fixture soon begins to emit a disgusting odor. The reasons for this will be fully given in another place.

I have added a house trap vent pipe and an interior rain water conductor, because these are common accessories. To be consistent the lead safe waste pipe should also be vented, for if it is ever to come into service at all its service

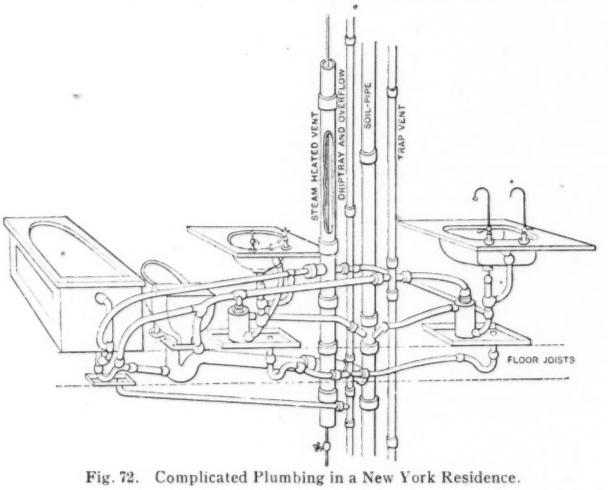


Fig. 72. Complicated Plumbing in a New York Residence.

will consist in carrying off dirty water. A trap at its bottom will inevitably soon have its stagnating seal evaporated out, and air from the basement will rise through it into the rooms, carrying with it the impurities coming from the entire length of the pipe. With a simpler system of

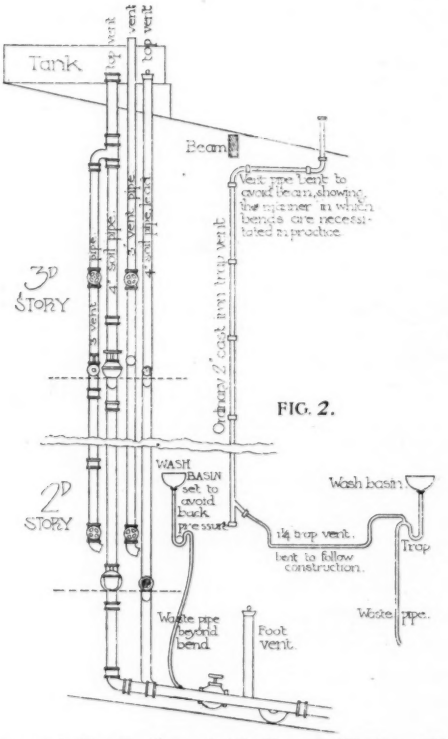


Fig. 73. Apparatus for Trap Testing used at the Museum of Hygiene at Washington.

plumbing one of the chief objects of a safe and its waste pipe would be eliminated, and this item of expense, complication and danger would be avoided.

Thus one evil involves another. Unnecessary complications exact others which are necessitated by them, and a departure from the all-important rule that "other things being equal the simplest is the best" is certain to result in an endless train of cares and troubles.

The next cut (Fig. 71) shows a portion of a wash basin and bath-tub in another New York residence. Part of the casing has been removed to show the work. What wonder that the poor plumber makes his frequent and serious blunders in the connection of his pipes—"by passes,"—so called! What wonder that the unhappy house owner becomes utterly discouraged at the sight of all this confusion, and thenceforth resolves to make it his chief mission in life to dissuade his friends from indulging like him in the luxury of set plumbing!

The money thrown away on all this worse than useless piping should have been devoted to obtaining stronger and better fixtures, setting them in a handsome and workmanlike manner and co-operating with the city fathers in installing a scientific and beautiful system of street sewers.

Finally Fig. 72 shows in perspective still another illustration of the extravagances complication* has introduced into plumbing work. It is from a house in New York City and this one part of it contains 72 joints. In another place I shall show how better results could have been attained with 16 joints.

Apparatus used at the Museum of Hygiene at Washington.

One other illustration of trap testing apparatus upon which interesting experiments on siphonage have been made is given in Fig. 73. This apparatus was used at the Museum of Hygiene, U. S. Navy Dept. at Washington, and they showed substantially the same results as the experiments already described.*

*From William E. Hoyt, S. B., C. E., paper on "Safety in House Drainage," published in the "Popular Science Monthly" for July, 1888.

*See appendix for full description of these tests at Washington, and the interesting discussions to which they give rise.

Recent Progress in Sewage Purification in England.

By Gilbert J. Fowler, M. S. F. I. C., Superintendent and Chemist, Manchester Corporation Sewage Works, England.

IT is with pleasure that I have acceded to the request of the Committee on Sewage and Sanitation of the American Society of Municipal Improvements, conveyed to me by the Chairman, Mr. W. K. Eldridge, that I would furnish a paper on the subject of sewage disposal for the convention at Milwaukee.

Though the time allowed me is very short, I esteem it an honor to be able to lay some results of recent English practice before a society, the proceedings and objects of which must be of the greatest interest to all who have the efficient carrying out of municipal works at heart.

In writing of recent progress of sewage purification in England I shall endeavor to avoid unnecessary detail, and to distinguish, as far as possible, between methods and results which may be taken as established and those which still await the test of time. It is impossible in such a paper to treat the subject exhaustively, and it therefore has seemed best to confine my observations largely to such work as I have been myself in charge of, or of which I am in a position to speak with fairly intimate knowledge.

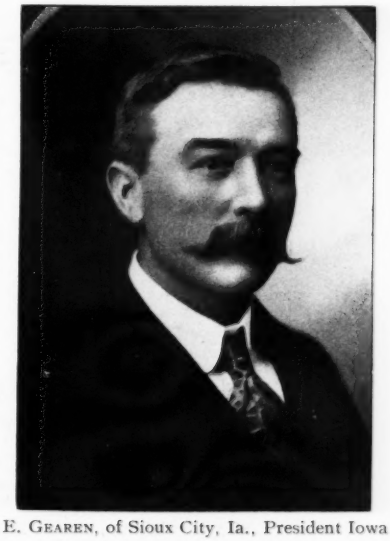
It will not be necessary to enter at any length into the history of the development of methods of sewage disposal, prior to recent years.

The general adoption of the water carriage system has compelled authorities to find means of purifying their sewage before entering the nearest water course.

Methods of chemical precipitation succeed in clarifying the sewage, with the production of large quantities of sludge, and an effluent which still contains organic matter in solution capable of putrefaction.

The conclusion of the Royal Sewage Commissioners appointed in 1857 is still upheld by the authorities at the Local Government Board, viz., that land is the best medium for the final purification of sewage.

The rapid growth of towns, especially in such districts as Lancashire, has rendered the acquirement of the necessary acreage of land in many cases practically impossible, and it is really this fact which has caused special attention to be given to more artificial methods in England.



JOHN E. GEAREN, of Sioux City, Ia., President Iowa State Association of Master Plumbers.

Another royal commission has recently been appointed, and is at present investigating the newer methods, and its conclusions will be awaited with great interest.

The first experiment on what is known as the bacterial or biological method of sewage treatment were those of Mr. Dibdin, then chemist to the London County Council. These experiments were on a small scale and resulted from the consideration of the natural processes of purification taking place in rivers and streams and of work in conjunction with Dr. Dupre. Mr. Dibdin drew attention to the researches of Warington, Schloesing and Munty, and others, who showed that the changes which manure undergoes in the soil were due to the action of organisms.

In 1887 a series of experiments were started by the Massachusetts Board of Health, which have been continued up to the present time. The Massachusetts work was chiefly directed towards the investigation of the suitability and efficiency for sewage purification of the various sands and gravels to be met with in the State, and endeavor was made to obtain a high degree of purification Consequently but little sewage was dealt with per given area, and the total amount of sewage experimented with was small.

These experiments, however, served to define certain essential principles which must be followed for effective purification by intermittent filtration.

The importance of their chief conclusion cannot be exaggerated, viz.:

"The purification of sewage by intermittent filtration depends upon oxygen and time; all other conditions are secondary."

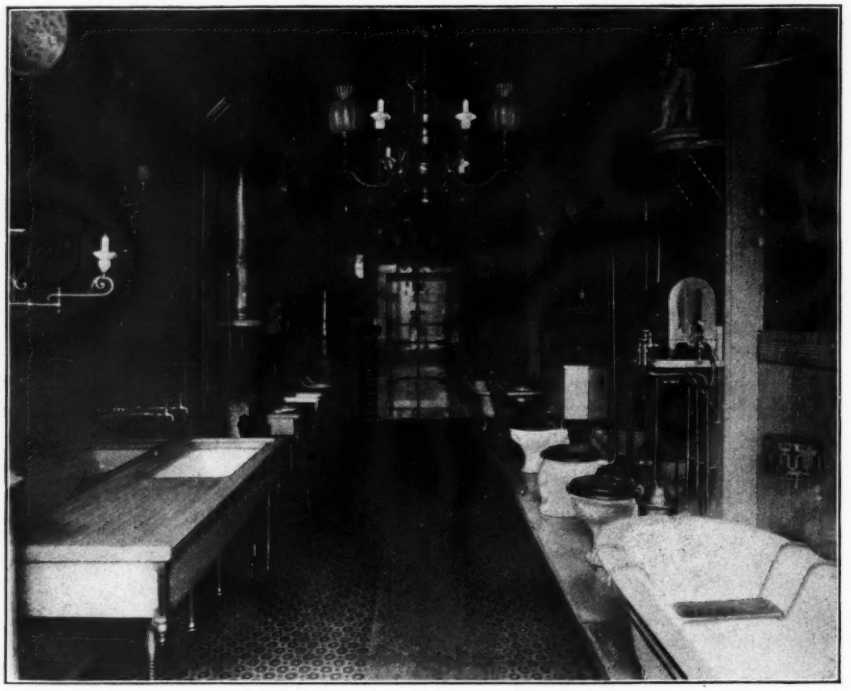
Although recent work has shown the importance of those actions which go on in absence of air, which are due to the activity of anaerobic organisms, yet the most recently devised methods are those which endeavor at some part of the process to maintain the above conditions.

In England, on the other hand, such a condition of things is rare, and if there be any land at all available in the vicinity of a town, it is frequently of such a nature as to be highly unsuited for sewage purification. Recourse must, therefore, be had to more artificial methods, such as those used by Mr. Dibdin.

The Barking filter of coke-breeze is typical of many others which have succeeded it, and so also is the method of working.

When sewage comes in contact with a fine material, such as sand or soil, an appreciable time elapses before it will percolate. The time condition above referred to may therefore be obtained by simply allowing the sewage to flow slowly through the sand.

In the case of a coarser material, such as coke-breeze, the rate of flow would be too rapid to admit of purification; and unless special means of sprinkling or otherwise distributing the liquid is resorted to, channels tend to be formed through the material, along which the liquid will find its way. In order to bring all the parts of the filter into operation without having recourse to such methods as above indicated, the exit of the Barking filter was closed, and the liquid allowed to run into the bed until the



One View of a Handsome Plumbing Store.

In 1892 Mr. Dibdin began his experiments with coke-breeze filters at Barking, on which a much larger amount of sewage was dealt with altogether and per given area than in the Massachusetts experiments.

The difference between the earlier experiments of the Massachusetts chemists and those of Mr. Dibdin illustrate the difference between the problem as it presents itself in England and in America.

In America there are large, sandy or gravelly tracts highly suitable for the purification of sewage, provided it be applied in comparatively small quantities per acre.

latter was full. After remaining in contact with the coke-breeze for a certain period, usually two hours, the now purified sewage was allowed to flow out, and after a period of rest the bed was again filled. Operating in this way something like a million gallons of the effluent from chemical treatment by lime and copperas could be purified on an acre of coke-breeze. The actual chemical changes taking place in such a bed as this will be discussed later.

In 1895 two experimental filters were constructed by Sir Henry Roscoe at the Manchester Corporation Sewage Works in order to deal, as in the case of the Barking filter,

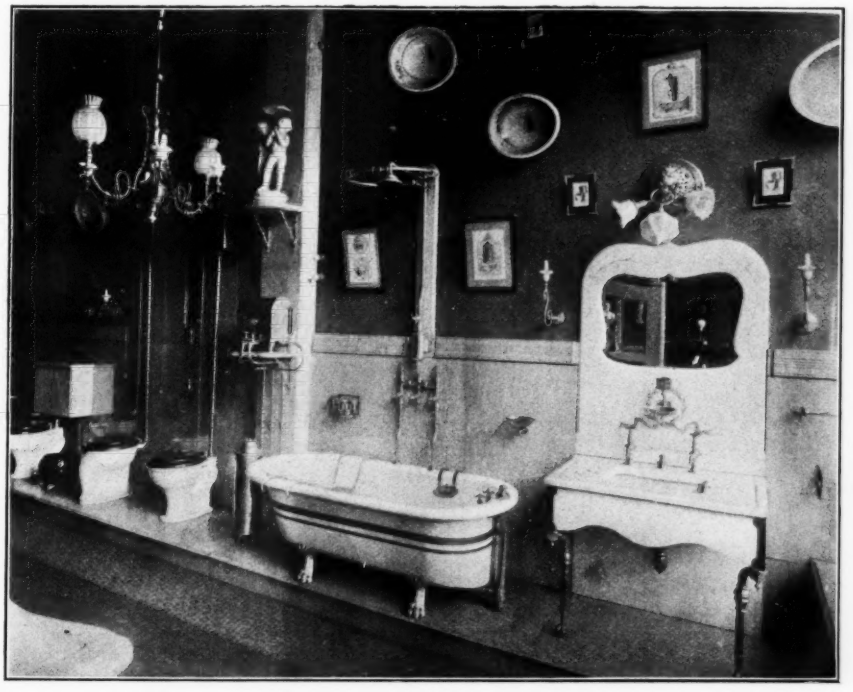
with the effluent from lime and copperas treatment. These beds were constructed respectively of coke and clinker, graded from the bottom upward, pieces in the bottom layer being several inches in diameter, the upper three inches consisting of material of about ⅛ inch diameter; above this was placed in each case three inches of gravel. The depth of the beds was three feet and the area twenty-five square yards.

Mention has been made of the size of the material in this case, as the matter is one of considerable importance. These filters are working at the present time, having been in continual operation since December, 1895. During last year, after allowing for all periods of rest, they dealt with a volume of effluent equivalent to upwards of seven hundred thousand gallons per acre per day. In course of time the surface of these beds has risen considerably above its original level, being converted more or less into the condition of soil, leaving a practically clean substratum. This result is of importance and will be further considered in dealing with the general question of the capacity of filter-beds.

The success of the Barking experiments led Mr. Dibdin to investigate the possibility of dealing, not simply with the clarified effluent, but with raw sewage. If this could be done, a great saving would be effected, both in the cost of chemicals needed for clarification and in the treatment of the resulting sludge. To test this point experiments were made at the village of Sutton, in Surrey, in which the operation described in connection with the Barking filter was carried out on two sets of beds, an upper and a lower, the upper being filled with coarse lumps of burnt clay and the lower with fine particles of coke-breeze.

Crude sewage after passing through a screen was admitted to the upper bed, and after remaining in contact for an hour or more, was led on to the lower bed, after contact with which it was found to be efficiently purified.

The chemical changes taking place in all the above filters have been shown to be to a very large extent due to the action of the aerobic organisms, although probably some amount of anaerobic change also takes place. It is probable that a large part of the destruction of organic matter takes place during the periods of rest, when the bed is full of air. The nitrate then formed acts as an oxidizing agent towards the fresh dose of sewage. The process is therefore one of alternate nitrification and denitrification. In the case of beds constructed after the Sutton pattern, the denitrifying process is most active in the primary bed, the effluent from which seldom contains nitrates; in the lower or secondary beds the nitrification process predominates and nitrates are generally found in the filtrate.



Another View of a Handsome Plumbing Store.

About the same time that Mr. Dibdin was conducting his experiments at Sutton, Mr. Cameron, the burough surveyor of Exeter, patented the now famous septic tank. This is simply a covered tank, through which the sewage is allowed slowly to pass, depositing solid matter as it flows. In course of time a vigorous anaerobic fermentation is set up, resulting in the solution of the suspended matters, with simultaneous evolution of gas (chiefly methane or marsh gas) and the production of a thick scum, which covers the surface of the liquid in the tank. In the original patent specification it is stated that the tank may be open or closed, and special devices are described for intercepting grit and for causing the sewage to enter and leave the tank below the surface of the scum.

The effluent from the septic tank requires to be further purified before final discharge, and is therefore led on to beds constructed either of clinkers or coke-breeze, on the

plan of the Barking filter. The firm of Cameron, Commin & Martin have patented a number of most ingenious devices for causing the beds to fill and empty automatically within given periods, thus dispensing with the need for attendants.

To describe these different mechanisms in detail would be impracticable in short compass and without the use of diagrams. Their general principle consists in an arrangement of buckets and levers, the bucket and inlet valve of the filter being at one end of the lever and the exit valve at the other. As the bed fills, the filtrate overflows into the bucket, causing first the inlet valve to close and directing the flow into the next bed, and eventually when the bucket is full it tips, and opens the exit valve, causing the bed to discharge. By an arrangement of connected wells and syphons, the discharge of one filter empties the bucket of the next in order, so that it is ready to receive the overflow as above described.

Numerous other automatic mechanisms for filling and emptying beds intermittently have been devised, which are difficult to describe without the aid of diagrams.

Of these the patents of Adams and of Ridgway may be mentioned.

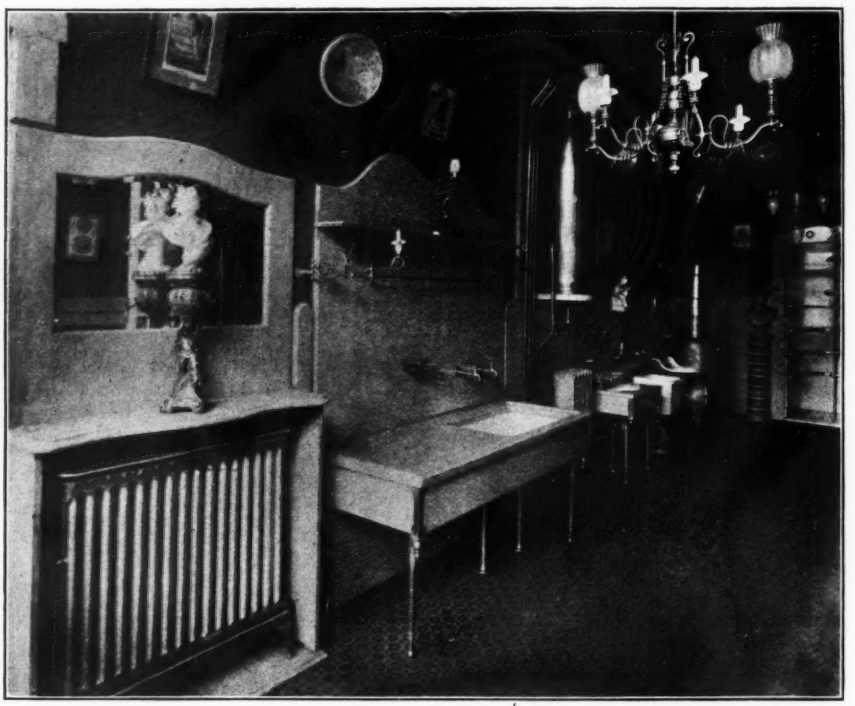
In the Adams apparatus the flow is diverted when the bed is full by means of a float which closes the inlet valve, and the bed is discharged by means of a syphon which comes in action after a specified time. This arrangement has worked well at Sutton.

The Ridgway apparatus is constructed with a view to admitting the sewage or effluent on to the bed to successive small doses, each dose flowing slowly through the bed, which thus acts on what may be termed the intermittent continuous principle. The inlets to the various filters are successively opened by means of cams fixed on a shaft, each cam coming into action after a certain amount of sewage has accumulated beneath an actuating float. This appartus has given good results at a small works at Hale, in Cheshire, and is being installed elsewhere.

All these mechanical devices are controlled by the rate of flow of the sewage. There are reasons which render it desirable that some apparatus should be constructed which is independent of the sewage flow, and the application of electricity is receiving consideration.

It has been mentioned that in all beds worked on the Dibdin method of intermitten contact the chemical change is one alternately of nitrification and dentrification.

It would obviously be an advantage if air could continually be supplied to the sewage, resulting in continuous nitrification.

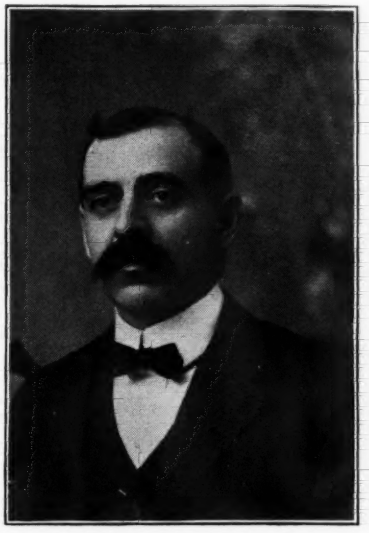


A Third View of a Handsome Plumbing Store.

.The earliest filter on this principle to attract attention was that of Col. Ducat, now at work at Sutton and at Hendon. This filter is about eight feet deep, constructed of alternate layers of clinker and "aerating layers" of pebbles and pipes. The walls are built of three inch drain pipes, set in cement, the inner ends being three inches lower than the outer to prevent the sewage running out. The sewage is distributed on to the bed by automatic tipping channels. In order to prevent freezing during winter, the filter is covered by a roof, and arrangements are made for artificial heating.

A simple form of continuous filter is that of Messrs. Whittaker and Bryant, which is in application on a large scale at the sewage works at Accrington, and experimentally at Leeds. Here the beds are made of rough coke, piled in heaps without side walks, and about nine feet in

height. The effluent from an open septic tank is sprayed upon them by revolving sprinklers. This method necessitates either considerable fall, or a resort to pumping. Messrs. Whitaker and Bryant heat the sewage by the waste steam from their pumps, and so make the bacterial process more active, and maintain the action in cold weather.



F. H. SCHULER, retiring president of the Minnesota State Association of Master Plumbers, Minneapolis, Minn.

The continuous filter of Mr. Stoddart, the city analyst of Bristol, requires less fall, and has no moving mechanism. The bed is constructed much in the same way as the Whittaker bed, six feet being the minimum depth; but the distribution is effected by means of corrugated sheets of galvanized iron. The upper edges of the corrugations are perforated and through the lower edges nails are fixed at regular intervals. The liquid passes through the perforations and collects at the nails, from which it flows in discontinuous drops on to the filter.

All these continuous filters are capable of dealing with a greater amount of liquid per given area than the ordinary Dibdin contact bed, from three up to as much as eight million gallons per acre per day being claimed under different conditions.

To resume, then, the chief methods at present under consideration in England are developments of the following:

1. Treatment of raw or partially settled sewage by double contact on beds of coke, clinker or burnt clay. (Sutton method, chiefly aerobic.)

2. Treatment of raw sewage in the septic tank, followed by single contact on beds of clinker, etc. (Exeter system, combination of anaerobic and aerobic.)

3. Treatment of effluent from settling tanks, or from septic tanks, on continuous filters of considerable depth, provided with special means of distribution. In this form of filter continuous nitrification results.

There is no doubt that by any of these methods ordinary domestic sewage can be efficiently purified without the use of chemicals or of land. A very large amount of research, however, has been carried out, and is still required, in order to determine the limits of efficiency of these processes under different conditions.

The questions to be decided were such as the following:

1. Would these methods, while successful in purifying domestic sewage on a comparatively small scale, be equally effective in dealing with the sewage of large manufacturing towns, containing trade refuse of every description?

2. Would the filters, contact beds or bacteria beds, as they are somewhat indifferently termed, retain their efficacy unimpaired, or would it be necessary to renew the material from time to time?

Such were among the chief problems which had to be dealt with in the case of Manchester, and in 1898 the Council of the corporation appointed three experts, Prof. Percy Frankland, chemist and bacteriologist; Prof. W. H. Perkins, Jr., chemist, and Mr. Baldwin Latham, engineer, to advise and report on the treatment of the sewage of the city.

The experiments which I had the pleasure of carrying out under the instruction of these gentlemen are described in a report and supplement, dated respectively October 30th, 1899, and January 16th, 1900.

They may be classified as follows:

1. The treatment of raw sewage on bacteria beds by double contact.

2. Treatment of settled sewage on bacteria beds by double contact.

3. Experiments with open and closed septic tanks, and treatment of the effluent on bacteria beds by single contact and also double contact.

4. Experiments on the purifying effect of dissolved oxygen and nitrates in the filtrates.

5. Experiments on storm-water.

In regard to the treatment of raw sewage on bacteria beds, it was soon found that with a sewage containing so much silt and detritus as Manchester sewage a preliminary settlement was necessary if the beds were not to become choked. This will probably be required in all towns where the suspended matter in the sewage consists to any large extent of inorganic matter, and this will usually be the case where the separate system of sewerage is not in force. In wet weather, especially, large quantities of grit are washed down from the streets, and particles of straw and chaff have been found, both in Manchester and London, to be very difficultly destroyed in the filter.

Both with raw sewage and settled sewage, however, good purification resulted with double contact in spite of large and varying quantities of trade refuse, such as galvanizers' waste (chiefly ferrous chloride), tar products, including carbolic acid, dye-waste, etc. It was found from this and other series of experiments that as far as Manchester sewage is concerned, the apprehensions which had been entertained as regards the injurious effect of manufacturing refuse were unfounded.

It must, howver, be emphasized that a conclusion may be drawn from one town which is not valid in all cases. In Bradford, for instance, large quantities of grease are produced from wool washing; this will rapidly choke any filter if it finds its way to it, and probably in this case it

will be necessary for the manufacturers to treat the refuse in some way before admission to the sewers. In Huddersfield, again, exceptional quantities of dye-waste are present in the sewage, and it may be advisable to decolorize by means of chemicals before treatment on bacteria beds.

The experiments with the closed septic tank were made with an installation laid down under the supervision of the patentees, Messrs. Cameron, Commin & Martin, and a set of beds provided with automatic gear received the effluent from the tank. The tank had a holding capacity of 20,000 gallons.

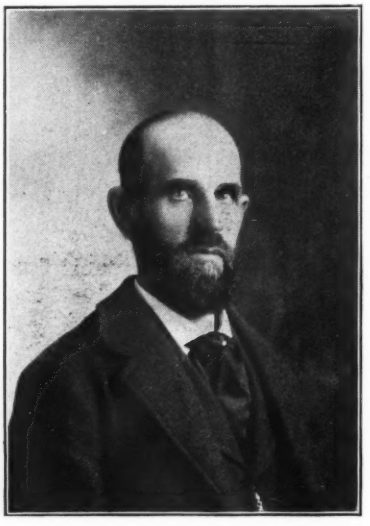
The open septic tank was simply obtained by allowing sewage to flow slowly through one of the large precipitation tanks in use at the works capable of holding 1,118,000 gallons.

Both the open and closed tanks were worked at a rate averaging approximately twice their contents per diem (rather less in the case of the closed tank). This was found to be the maximum possible rate for effective work. I am inclined to think that where possible tank capacity for at least a day's flow should be provided.

A number of interesting results have been obtained from the working of these tanks.

The effluent obtained from each tank was almost identical in composition and appearance.

It does not appear, therefore, that the roofing in of the tank is necessary from the point of view of the chemical changes taking place. The scum which appears in both



J. V. CUNNINGHAM, Winona, Minn., an active member of the State Association of Master Plumbers.

tanks after an interval of a few months acts to some extent as a cover. The chief advantage of a roof appears to be to prevent the scum being blown about by wind, to prevent any possibility of nuisance, and to enable the gas produced to be collected.

As regards the possibility of nuisance, this in Manchester does not appear likely to be of any moment. In bright, open weather little or no smell is perceptible from the tank; only on damp, still days some miasma is apparent. It is possible that the tarry refuse in Manchester sewage acts in some degree as a deodorant. Moreover, the rate of flow is not without effect, a slow rate tending to produce a more putrescent effluent than a fairly rapid flow. The matter will doubtless have to be decided according to local conditions.

The borough surveyor of Leicester has reported adversely to the septic tank, on account of nuisance, preferring purely aerobic methods. On the other hand, no complaint has arisen in the case of open septic tanks at Leeds and Accrington.

In the same way the question of the advisability of collecting the gas will depend largely on the character of the sewage. Measurements made in Manchester do not lead to the hope that much profit can be made in this direction, but the amount of gas given off would probably be much greater with a stronger and more purely domestic sewage.

A very important question to decide is the amount of sludge which is actually destroyed in the septic tank. To begin with, of course, all insoluble inorganic matter, such as sand and grit, etc., will remain unaltered, and here is apparent the effect of such trade refuse as galvanizing waste. The iron in this becomes converted into a sulphide of iron in the septic tank, and is deposited therein or finds its way in a finely divided state on to the filter beds. In Wolverhampton the quantity of iron salts in the sewage is so great as to rapidly silt up the experimental septic tank at work there. This takes place to a less extent in Leeds* and Manchester.

The experiments in both the last mentioned towns lead, however, to the conclusion that with tank capacity equal to a 24-hour flow in the case of Leeds, and rather less in the case of Manchester, something like 50 per cent of the total sludge can be destroyed in the septic tank, and the latter should not require cleaning out more than once a year. With purely domestic sewage or sewage entirely of an organic nature the life of a septic tank will probably be much longer.

In Exeter, for instance, the tank has continued at work satisfactorily for several years, and at Yeovil, where a large quantity of water from skin dressing works enters the sewers, the tank has been at work for upwards of three years.

Although the septic tank cannot be said to abolish the sludge difficulty altogether, a very great economy should result from its adoption, and the experiment is now in progress at the London outfall works of running their tanks on this principle for six months, in order, if possible, to reduce the large expenditure now incurred in taking the whole of the sludge to sea.

Futher advantages have been obtained in Manchester by the use of the septic tank, viz.:

1. The effluent obtained is of a much more uniform composition than the ordinary sewage.

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*"The Bacteriological Treatment of Sewage," by W. H. Harrison, B. Sc., Journal Society of Chemical Industry, June, 1900.

2. It much more readily undergoes nitrification.

Whereas it has been found that double contact is necessary for the purification of raw or settled sewage, septic tank effluent, or septicized sewage, as we may term it, can generally be fairly well purified in one contact, and invariably in two. In Yeovil, where the sewage is excessively foul, the filtrate from a second contact is of good quality, and in Manchester it has been found possible to obtain a good effluent with oe contact, and an absolutely satisfactory one with two contacts, even when the secondary bed receives the filtrate from two primary beds.

An important observation has been made that if a bed has become habituated to fresh sewage, it requires some time before it will produce the same results with septicized sewage, and vice versa. It is well to emphasize this point, as abnormalities which are sometimes observed in the results from beds may be due to variations in the condition of the sewage. If, for instance, an ordinary precipitation tank be left uncleaned, the effluent may become partly septicized and the action of a bed receiving the effluent may be temporarily impaired.

While it may be taken as certain that a good effluent may be obtained by the various methods indicated above, yet the important question remains, will not the inorganic suspended matter, which, in however small quantity, is passing into the bed with the sewage or septic, effluent, tend to reduce the capacity and finally choke the bed?

This question has been very carefully considered in Manchester, and much has been learned from the Roscoe filters described in the earlier part of this paper.

The conclusions arrived at may be summarized as follows:

1. Suspended matters must, as far as possible, be arrested by means of catch pits and the septic or settling tank before passing on to the beds.

2. The beds must be constructed for the most part of tolerably fine material, a mixture of sizes from 1½ inch to ⅛ inch will probably be found most economical. The drain pipes should be protected from choking by placing large pieces of clinker around them. A layer of about six inches of fine screenings should be placed on the top of the bed.

3. The effluent should be admitted on to the bed as far as possible, so that it spreads out in a thin sheet over the surface.

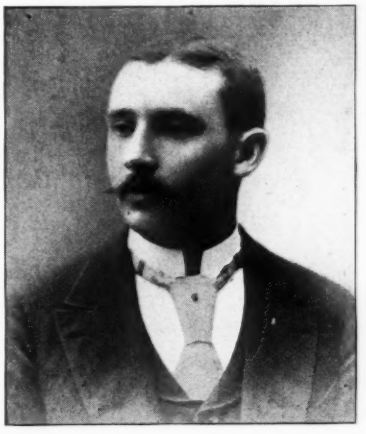
4. The bed should not be disturbed below the upper layer of fine material. At regular intervals besides the usual rests between the fillings a longer rest of several days should be allowed.

6. From time to time any accumulation on the surface may be removed, or possibly the whole upper layer replaced by fresh material.

Operated in this way, there is good reason to hope that after the preliminary loss of capacity due to consolidation of the material and the growth of organic life in the interstices, the capacity of a filter may be maintained to an extent equal to one-third the capacity of the empty filter tank without filtering medium. A filter so constructed, three feet deep, should deal with 500,000 gallons of septicized sewage per acre per day, allowing for periods of rest.

This has been done in Manchester, and has been accomplished also in Oldham with filters covering altogether about four acres, some of which have been purifying a chemical effluent since 1897, and have dealt with settled sewage for most of last year.

It is only fair to say that other places have not always been so successful. The difficulties of Bradford and Huddersfield have already been touched upon. In Leeds also the contact beds have gradually silted up. In each of these towns, however, the sewage is of a particularly difficult character to deal with, and, moreover, the construction and method of working the contact beds has been different from that described above.



C. W. Rosene of Des Moines, Iowa, retiring president of the Iowa State Association of Master Plumbers.

In Sheffield and Leicester contact beds have given such good results that schemes have been devised for dealing with the whole sewage of the city with contact beds, supplemented in the case of Leicester with a large acreage of land. The Sheffield scheme has already received the assent of the authorities.

For Manchester the experts advised a total acreage of 60 contact beds. The local government board, who have the granting of the loan, recommended 92. The matter will shortly be considered by the City Council, who will decide which scheme, if either, to adopt.

The corporation of Salford are proceeding with a scheme devised by the borough engineer, Mr. Corbett, of roughing filters and continuous filters provided with sprinklers and eight feet in depth.

It has been claimed that continuous filters, such as the Whittaker and Bryant filter, described above, obviate altogether the clogging difficulty, inasmuch as the filter being constructed with large interstices enables the suspended matter to pass through, when it can be readily separated from the filtrate by settlement.

The adoption of contact beds or continuous filters will probably depend on cost and on local conditions. Where there is little fall the cost of pumping and of extra settling tanks may be considerable. The filters must in general be more costly than contact beds to construct, on account of the greater quantity of material per unit area and the impossibility of utilizing any but the larger portions.

The question of the supply of clinkers is a considerable one. The cost of carriage is the most serious feature. The quantities available are enormous, and a large business has arisen out of the demand for clinkers, consisting in buying up the great waste heaps in the manufacturing districts of England and separating mechanically the various components.

Wm. B. Griffin, Waterloo, Ia., an active member of the Iowa State Association of Master Plumbers.

I have allowed myself little space to speak of the treatment of storm water or the purifying effect of well nitrified effluents.

The chief conclusions which have been arrived at in Manchester as to the treatment of storm water is that the first flush which contains the worst impurities should be dealt with as adequately as possible; afterwards the thinner sewage can be more perfunctorily treated. Twenty-five acres of roughly constructed beds will be needed to deal with the storm water of Manchester; these will be worked lightly during periods of ordinary flow so as to keep them well stored with nitrates. They should then be capable of dealing with a large volume of storm sewage for a short time.

The right utilization of the nitrates in the filtrates and in the beds will enable, in my opinion, a considerable increase of work to be got out of a given area of beds. For it has been found that if only a portion of the sewage be so purified that it contains nitrates and dissolved oxygen, it is not only incapable of putrefaction, but will further purify its own volume of less effectively treated effluent.

I must now bring this paper to a close, which I fear has trespassed too long upon your attention.

I only hope that the information I have endeavored to lay before the convention may be found interesting and to some extent novel, and that it may contribute something to the progress of sanitation and to the betterment of the conditions of life, which it is one of the aims of your society to bring about.

Sewage Disposal and Water Purification.

Read by John N. McClintock, of Boston, Mass., before the American Society of Municipal Improvements.

CLEANLINESS is next to godliness. The laws of sanitation follow closely those of morality, and are of equal value in benefiting the temporal condition of our race. If they are neglected the people suffer and charge their unhappiness to an overruling Providence, when the blame should rest upon themselves for neglecting the laws of personal and civic cleanliness.

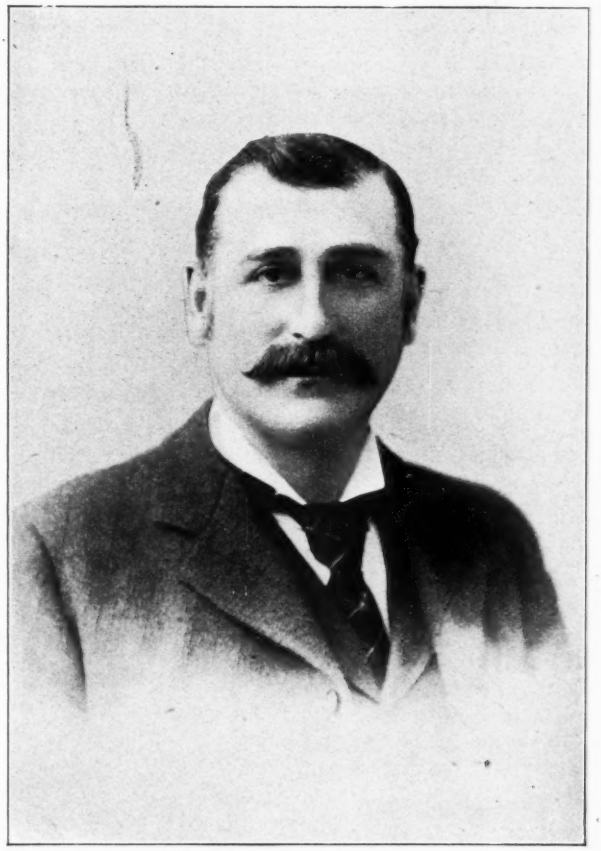
The first sanitary engineer of record, when the Hebrews marched out of bondage and were guided towards the promised land, laid down for his people a law of sanitation which the accumulated wisdom of the ages, gained by experience, pronounces good even to this day. Moses ordered the Jews to bury their wastes, lest the Lord see any unclean thing in their midst and turn away from them in anger. He did not direct them to convey their refuse outside the camp and pollute the surface of the earth and the air, or to turn the sewage into the river, or into the nearest spring of living water. To the ancients water was the emblem of purity.

It has been known for ages that the earth absorbed in time whatever of corruption was consigned to it; but that occasionally the process was attended with the contamination of the ground water. Engineers, scientists and city officials throughout the civilized world have for years been studying and experimenting on the problem of how to dispose of town and city sewage in such a manner as not to give offence. A solution of the problem of sewage disposal, providing at the same time a method of purification for water, has been discovered, which is so simple that the wonder is that it was not put in operation years ago.

It was not fated that the discovery should be made by any of the bodies of learned and scientific men in any part of the world, although large sums of money had been entrusted to them to conduct the most exhaustive experiments solely for the purpose of making the same discovery —the proper disposal of sewage. Neither was it the result of chance.

Many years ago an elderly man, far on the down-hill path of life, observed that a peculiarly constructed cesspool, which he had built for his own residence, was automatic in caring for the solids which were deposited therein. After watching it for five years, he found that no solids accumulated. Then onward, with this basic idea, aided by a succession of expert engineers, he continued his studies and researches until he had evolved a perfect system of sewage disposal and water purification which

he proclaimed to the world officially as his discovery. His great life-work accomplished, he was gathered to his fathers in the fullness of years and of honors. There is no danger of the credit being wrested from him, as for years he stood alone in his faith and belief until, toward the last of his life, he had brought many people to accept his theories. History and the scientific world will do him justice—if, as Achilles, he ever has a Homer to sing his praises. Charles Levi Woodbury quotes in one of his Fishery pamphlets, from the journal of the official English discoverer of America, that when he arrived in a port of refuge to discover and take possession of the country, in the King's name, there was a fleet of fifty vessels anchored there before he came into port—a fact which is noted to show that history even becomes a matter of official record.



JOHN A. FISH, OF BOSTON, MASS.

Who but lately has, after an honorable and active business career of many years' duration, retired from the management of The Gurney Heater Mfg. Co.

The system for sewage disposal consists of

1. A water-tight settling or septic tank, large enough to hold from eighteen to thirty hours flow of the sewage, through which the flow is constant, but so constructed that the outlet draws neither from the top or the bottom of the tank.

2. The effluent from the settling tank is received on the top of a coarse coke, cinder or gravel filter at the rate of one cubic yard for every hundred gallons of sewage per day. The sewage from the tank may be applied continuously or intermittently to the filter. The filter may be used in sections, the one operating while the others aerate may be used as contact bacteria beds which gradually fill up, rest, and slowly discharge.

3. The discharge from the coarse filter may be received on the suface of a finer cinder or sand filter intermittently, with at least one cubic yard of filtering material for every three hundred gallons of the effluent from the bacteria beds. If one cubic yard of the fine filter is provided for every hundred gallons of effluent per day, the purification should be absolute, as soon as the filters get into working order.

In other words, sewage disposal works should provide rating or settling tanks which contain half a cubic yard space and one cubic yard of coarse filter and one cubic yard of fine filter for each and every inhabitant,—about the amount of territory assigned for man's last resting place, the grave.

For sanitary, sentimental as well as for other reasons, it is well to protect the tank by a roof or covering and ventilate it, although the ventilation is not essential. A covering may or may not be placed over the two filters. There is no chemical or biological objection to their being covered by a layer of loam. The finer filter need not be protected, for the effluent which it receives from the septic

tank and bacteria bed is colorless, odorless and tasteless. The fine filter may be omitted when the discharge is into salt water.

To explain the workings of this system it is necessary to state that bacteria of putrification and nitrification originate with the sewage. The former are known as anaerobic bacteria, which work without air and include the germs of malignant diseases. The septic tank may be likened to the stomach, and the action of the bacteria to digestion. These bacteria vastly increase in numbers under the conditions offered in the tanks, do the work which nature designed them to accomplish for man's benefit, and having served their purpose disappear. They act, during their brief existence, to disintegrate organic matter, and convert it into its original inorganic element, in some such a way as combustion. Very little of the suspended organic matter of the sewage escapes from the tank, about 10 per cent of the dissolved organic matter, and only about 15 per cent of the number of bacteria which enter. Those which do escape are chiefly the amphibious or facultative bacteria, which operate either with or without air, and the aerobic bacteria, which require air. Those which do escape become attached to the surface of the filtering material and are sustained by the dissolved impurities which come with them. The best filtering material is that which offers the best surface for the bacteria to become attached to. Charcoal or coke proves as good as any, although cinders and burnt clay are very efficient.

Some bacteria escape from the coarse filter, are arrested in the fine filter, and continue their function of converting the dissolved impurities into plant food or inorganic elements. Doubtless there is in both of these filters a chemical as well as a biological action; for intermittent action introduces air throughout the filters; and it is possible that the bacteria having done their work become oxydized or consumed; for certain it is that the tempearture of the sewage going through the works perceptibly rises.

The above theories are advanced to explain what are now recognized as well established laws of nature. As the tank is like the stomach, the bacteria beds are like the lungs of an animal inasmuch as the air goes through the filter at regular intervals; for as a matter of course the system can be made to work automatically, its action depending upon the bacteria of the sewage, the flow of the sewage controlling its diversion from one bed to another by as simple a mechanical device as the shut off of a bathroom tank; while intermittent action in the fine filter is obtained by means of a syphon which slowly empties the coarse filter when it becomes thoroughly saturated.

The bacteria of the sewage as it enters the tank number about one million to the cubic centimetre. As the sewage is brought to rest in the tank these gradually increase to fifty million. It is supposed that nothing of an organic origin can withstand the action of these bacteria of putrification so that it seems probable that the septic tank will finally settle the problem of garbage as well as of sewage disposal.

At the experimental plant at Brentwood, New Hampshire, which has been in continuous operation for five years, the septic tank is protected by an ordinary roof, and is remarkable from the fact that septic action there does not give forth offensive or noticeable odors in the building itself, which, however, is ventilated into a shaft. The manurial value of the sewage may be saved and utilized as a fertilizer as at Brentwood, if it is desirable, by constructing the tanks with partitions, the first compartment holding the bulk of solids in such quantity that putrification is arrested. A common precipitant like lime will increase the deposit. This system conforms to the Mosaic law inasmuch as it buries the waste and refuse of the city beneath the surface of the earth; and leaves to nature assisted by the art of man the sanitary disposal of the sewage.

The septic tank on a large scale was first proposed for the City of Brockton, Massachusetts, in 1887, and is thus summarized by the officials who condemned it: "A settling basin, which without the aid of chemicals is intended to separate and retain the solid portion of the sewage with four divisions of this apparatus to allow for cleansing, all to be covered by a building having a central shaft or chimney for removing foul odors."

"The scheme as proposed is thoroughly impracticable. The settling basins would not cause the suspended matters to settle to a great extent."

The next attempt to install a plant of this character was made in 1895, for the town of Andover, Massachusetts, and consisted of "Two sets of double collecting tanks and two filter beds, thoroughly underdrained within a building ventilated through a four-foot chimney, seventy-five feet high, the effluent to have intermittent filtration out of doors through two and one-half acres of prepared filter beds under-drained, with three feet of sand covered with three inches of loam receiving the sewage from overdrains; or such a building without out of door filter beds."

These tanks as designed would hold the flow of twenty-four hours, and the coarse filters would receive the effluent at the rate per day of one million gallons per acre, while the out of door filters would receive the effluent from the first filters at the rate of twenty-five thousand gallons per acre per day, at the rate the sewage comes to the disposal works at Andover to-day, after the sewers have been built and in use for over two years. The system was received with the following welcome: "The board has carefully considered the proposed scheme and find it is a thoroughly impracticable one for the disposal of sewage. The settling tanks cannot be expected to remove more than a very small portion of the suspended matters. Moreover, there would be a constant flow of sewage through the proposed tank, while in the case of the experiment at Lawrence the liquid was not disturbed. The indoor filter beds are altogether inadequate and would very quickly become clogged. The filtration area outside would receive sewage from which only a small proportion of the organic matter had been removed. No special chemical or biological difficulties attend the purification of sewage by this form or filter. An area of about six acres of open filter bed properly prepared would be sufficient for the town in the beginning, but it would be desirable to provide for increasing the area when necessary."

The principle and action of the septic tank in liquifying the solid suspended matter in the sewage was not of common or even scientific knowledge at that date, 1895, so

its development must be looked for within the last five years.

The 1898 report of the Massachusetts State Board of Health, published in the fall of 1899, contains a full report of the experiments carried on at the experimental station to test the workings of the septic tank and biological filters and confirms all that was ever claimed for the system as to the degree of purification obtained. The water from the bacteria beds at times is freer from contamination than that of the Merrimack River at Lawrence, when it is pumped and filtered at the rate of three million gallons per acre per day, to be delivered for use for domestic purposes. On account of the septic action in the tank, the filters will operate for a very long time, perhaps perpetually, because those in use for more than two years show no indication of becoming clogged.

A sewage disposal plant has recently been constructed at Liberty, N. Y., described in a late issue of the Engineering Record, where the septic tank holds from twenty to twenty-four hours' flow. The coarse filter receives the septic tank effluent at the rate of eight hundred thousand gallons per acre per day; and the secondary filter receives the effluent from the primary filter at the rate of one million six hundred thousand gallons per acre per day. The tank is covered by a concrete roof, but the filters are open. The purification effected is perfectly satisfactory to town and state authorities.

The septic tank and single filtration is in operation at Andover, Mass.; and the tank reduces the area necessary for filtration from six acres, required by the State Board, to less than one-half an acre, and effects the most satisfactory purification of the sewage, equaling that where broad filtration is used without septic action.

Now, to apply this principle or apparatus to the purification of water.

If the health authorities of a municipality come to the conclusion that the water furnished is a menace to the citizens and needs purification before being offered for domestic purposes, a delay in erecting a proper purification plant is almost criminal. Officials should act quickly and not stop to experiment. An experimental station has been conducted by the Commonwealth of Massachusetts, from 1887 up to the present time, and the results of the experiments in the use of various material in the purification of water are given in full in the exhaustive reports of the Massachusetts State Board of Health for the years 1890 to 1898 inclusive, which are probably on file in the nearest public library and which should be, if they are not, in the library of every City Engineer.

When one first draws water through an iron water main there is present in the water unmistakable evidence of iron and iron rust which, however, soon disappear. If there were not a cessation of chemical action the iron main for water or sewage would soon become disintegrated, instead of lasting a century or more, when not exposed to the air or to electricity. The theory which explains the long life of the iron water main is that its surface becomes lined with bacterial life which not only protects the surface, but purifies to a certain extent the water passing through. The principle of a filter is that the surface of the filtering material becomes coated with bacterial life; and that filter is best which is best calculated to hold and maintain bacteria. Bacteria are present in the water when there is any pollution, and originate from putrification or fermentation from animal or vegetable sources.

The poorest filtering material known is glass or glazed pottery; the best is charcoal or coke. The bacteria find it difficult to cling to the former, while the latter offers an ideal surface. It may be possible that charcoal and coke are the best, because of the minute air spaces which they contain. Next in value to coke are cinders screened to separate the ash; and then comes burnt clay or broken bricks. Sand and gravel come nearer to glass than to coke. Generally where an artificial filter is to be constructed near a city, cinders are the most economical, for they have no value except for filling and road ballast, and can be run through a crusher and sorted by a rotary sieve to the most advantageous sizes. The finer the filtering material the more extensive the surface for maintaining bacterial life and also the more liable to become clogged; on the other hand the coarser the material the less the surface, but the longer the life of the filter, because there is less likelihood of its becoming clogged. Sand is perhaps the most frequently used for a filter because it is the most available. One should be able to purchase from the contractor a cubic yard of coal ashes for 10 cents, and sifted cinders sorted as to sizes should not cost over 50 cents a cubic yard. If the ashes were taken from a manufacturing establishment of the city the necessary amount could be quickly gathered. There is very little organic impurity in the ashes, and what there might be, the filter when in operation would quickly disintegrate and convert into harmless elements. Straining alone does not remove the dissolved organic impurities nor the harmful germs from the water.

To filter river water, one should take advantage of three natural laws. First, that of sedimentation as it comes to rest in a settling tank where suspended matter might rise to the surface or sink to the bottom. It would be well to arrange this tank in long and narrow channels, from each of which the supply could be shut off for the purpose of cleansing.

Secondly, it would be advisable if there is much suspended matter in the water to strain the effluent from these channels perhaps laterally through a three-foot wall of fine coke or cinders continuously, so that the anaerobic bacteria could get in their work.

Thirdly, the clarified water from the coke filter might be collected and periodically discharged on the surface of a coke or cinder, gravel or coarse sand filter five feet in depth, made of material that would go through a quarter-inch mesh and not through an eight-inch mesh. The surface might be flooded at each discharge every half hour to a depth of six inches. In the body of the filter there is about twenty inches air space, so that the six inches of water will be suspended by capillary attraction the whole sixty inches of the filter, and be subjected to the action of three times its bulk of air, while the aerobic bacteria on the surface of the filtering material will disintegrate the organic impurities brought to them by the water. When the next body of water is poured upon the filter the air and water already there are forced down into the under-

drains, the air escaping and the water being collected to be applied intermittently to the surface of a filter of the same dimensions as the first one, but composed of finer material, such as coke, cinders or even sand. If these filters are side by side, two million gallons of water can be purified on one acre, but if land is valuable the filters can be placed one above the other, so that six and one-half million gallons can be purified on one acre per day. A timber and tar and gravel roof might be of service during the cold snaps of the winter in northern latitudes, to protect the filters from the frost, but otherwise it would not be essential, except is some cases over the reservoir receiving the effluent from the last filter.

By this system is obtained the benefit of a settling tank and what of septic action will occur in the tank to liquify and disintegrate suspended impurities; the straining through three feet of coke or cinders; the double intermittent filtration of the water through ten feet of prepared filter bed where the water is subjected twice to over three times its bulk of air; and the myriads of bacteria clinging to the surface of every grain in the bed. The lateral coke or cinder filters can be built in bays, held in place by netting, and can be replaced in sections when they become clogged by river silt.

Any curious and investigating householder can test the efficiency of this system in the back yard, in the stable, or in the cellar, in a crude way. Let him take a small hogshead, clean it out, fill the bottom with clinkers from his furnace, the next layer with what will go through an inch mesh and not go through a common coal sifter, and the rest of the space with cinders which will go through a coal sifter and not go through a flour sieve, or with coarse sand or fine gravel. Across the open top of the hogshead rest two joists, and thereon place a wine or whiskey barrel with perforated bottom to receive an iron syphon; and filled with the same material as the hogshead, and arranged in the same manner. The syphon is fixed to empty the barrel slowly when the filtering material is saturated with water, discharging upon the surface of the filter in the hogshead. Above the barrel suspend a ten-quart wooden pail, as a up-bucket, so arranged that when it is full of water it will discharge its contents upon the surface of the filtering material in the barrel, and when empty returns to position to be again filled. Next arrange the faucet of garden hose so that it will fill the bucket in twenty or thirty minutes, and let it run for a few days until the filter gets into good working order,leaving the outlet at the bottom of the hogshead open. When the water runs pure and sweet, purified in nature's laboratory artificially prepared, the experimenter can let enough water run to supply the daily needs of the family, and then shut off the supply. This filter can be arranged so that when the water rises to a certain height in the reservoir in the bottom of the hogshead, the supply can be cut off automatically. Any ingenious plumber can design and construct the apparatus. When the filtering material in the barrel becomes clogged by the river silt, as it undoubtedly will in the course of time, it must be renewed. This design if carried out may possibly preserve some young life which otherwise might be sacrificed, while awaiting experiment by the city officials. A few days and a few dollars would demonstrate the value of this principle; but every day of delay means danger to citizens and those tarrying in the town. No one should offer water to drink which is known to be polluted and dangerous to health under any circumstances.

After constructing a water purification plant where necessary, let the city or town build sewage disposal works and take the sewage out of the river, lake or harbor, for the benefit and health of those dwelling on the banks. When the city has put in operation the filter and disposal works, all inhabitants living on the water-shed should be warned that people are using the water for a water supply, and demand that it be kept pure and free from sewage pollution. There is common and statute law enough to protect the town from the filth of their neighbors, if any one cares to enforce it.

If the source of water supply is reasonably free from sewage, or other contamination, single filtration is frequently all that is necessary. Where the supply is taken from a river which receives surface drainage as well as sewage, too many precautions to guard the purity of the supply cannot be taken. It is well to err on the safe side.

The system of water or sewage purification by double filtration or by combining the settling or septic tank with single or double filtration permits any community to enjoy the blessing of pure water, and may prevent their polluting by sewage any body of water which may be a source of water supply to their neighbors. It permits, on account

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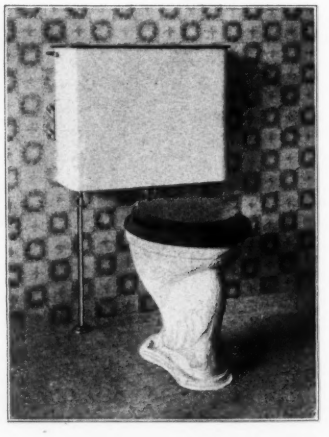

of the small area necessary to be used for water or sewage purification, that the territory employed for carrying out the scheme may, above the surface, be devoted to other purposes, such as recreation grounds, parks, gardens or lawns, and prevents what is usually an offensive operation from becoming a nuisance in any neighborhood.

The Mississippi River, the father of waters, with its thousands of tributaries, draining a continent, is naturally the fountain of youth which De Soto sought. Its water is remarkable in that it will purify itself in time, and can be carried around the world without becaming putrid under the tropical sun. As the population in the valley increases the danger of contamination increases; and to guard the health of the people its pollution should be prohibited. True, its bulk is vast, but bacteria of disease and putrifaction have a wonderfully prolific way of increasing in numbers, as is shown on the culture plate, and the water may carry the germs of diphtheria, tuberculosis, as well as the cholera, the typhoid, the black death, the bubonic plague, and spread the scourge over the continent. Some of the germs of contagious diseases are known to withstand the rigors of a Northern winter, and are revivified by the summer sun, after having been enclosed in blocks of ice. They are most active in the water when the lake is covered by its wintry coat of ice. The water-shed of the Great Lakes, like that of the Mississippi, should be exempt from the effects of sewage pollution as far as is practicable, and its waters be a reservoir of the life-giving element for the use of all.

The time is approaching when the national government as well as the state and municipal government must take this matter in hand and enact laws to protect the health of American citizens as well as their "life, liberty and pursuit of happiness," guaranteed by the Constitution, for of what value are all these without health? The interstate rivers and lakes are especially within the jurisdiction of the general government, and it is suggested that the next new member of the Cabinet should be the Secretary of the Public Health.

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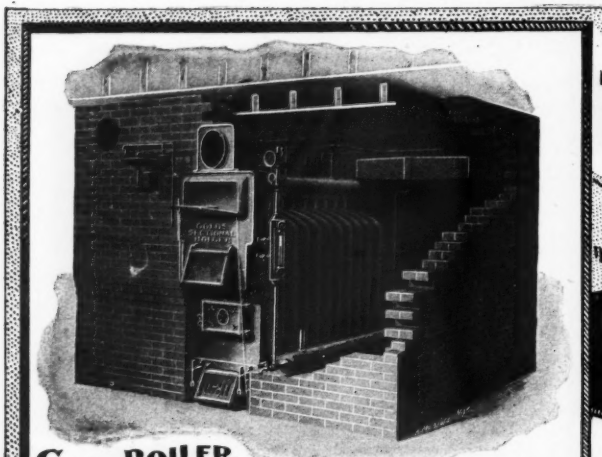

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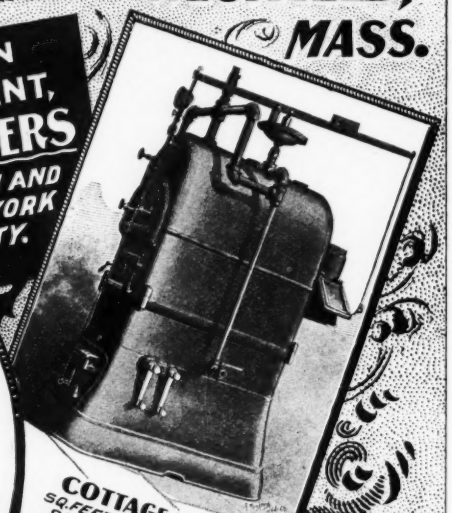

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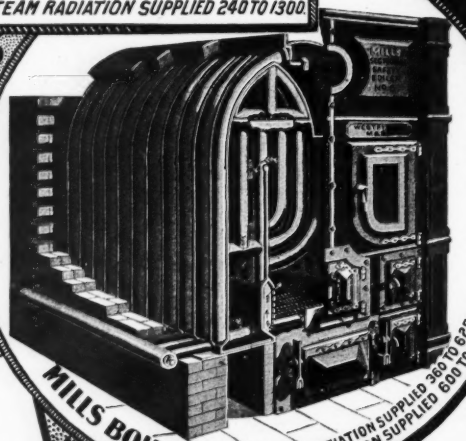

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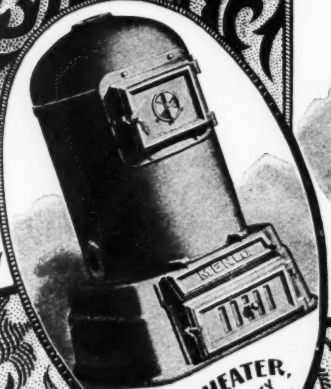

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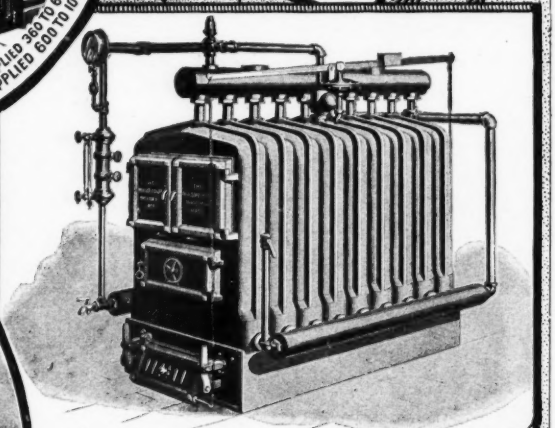

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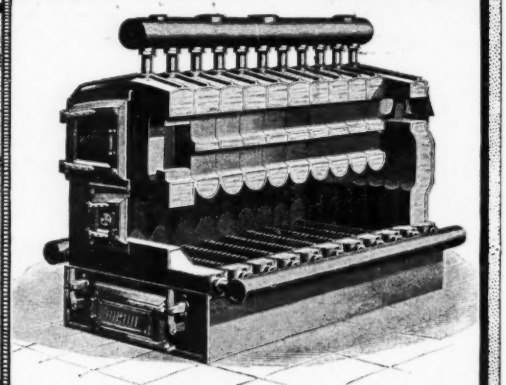

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The Element of Time in Contracts.

Read by Reginald Pelham Bolton at the recent meeting of the American Society of Heating and Ventilating Engineers.

VEXATION and uncertainty surround this simple phrase to the engineering contractor. It is the one indefinite item in his estimates, the only untormulated feature in his studies, and yet the essential and fruitful cause of difficulty in his business.

In the nature of things, it cannot well be otherwise, but it is difficult for an impatient client or a distracted purchaser to understand such a statement

It remains, however, the fact that all forms of construction involving the use of metals, are especially liable to delays, due to the nature of the materials dealth with, the variety of operations necessary to their formation into a completed shape, and where, erected as part of a building, or other structure, to peculiar hindrances and delays of other parts of the construction, often to an extraordinary and quite unexpected extent, all of which are frequently inevitable.

In no other trade do so many elements contribute to this result. Tubes, plates, beams, angles and bolts, dependent on arrangements of mill management, compound structures involving forgings or castings which develop unexpected flaws and failures, and breakdowns of machinery operating upon all of the above, go hand in hand with the unwillingness or incapacity of workmen in creating unforseen conditions.

The law upon the subject is in all countries as uncertain of application as the subject itself, and the legal faculty seems to have no definite or substantial grasp of the special

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difficulties of engineering construction, for the most part interpreting the law by that jack-in-the-box known as "trade usage," which is almost always sprung by one side or the other upon an unhappy and untechnical court.

The whip-lash of consequential damages, which is so often held over the head of the delinquent contractor and manufacturer, is perhaps more of a bugbear than a reality, for the difficulty of demonstrating directly consequential loss has, perhaps, fortunately, to be faced; nevertheless, it is notorious that numerous cases of unjust penalties have been inflicted, not only by sympathetically-inclined juries, but by lenient arbitrators and judges, who not infrequently are led to decisions of such a nature, in cases where there is much contradiction, on the theory that where there is smoke there must be fire, or that delay is synonymous with negligence.

All this leads to the hope that when the codification of mercantile law is really and seriously undertaken, this question will receive early attention, and that it will be definitely made clear that claims for damage by delays, and excessive claims for consequential results, shall not be brought, as they are, only too often, for the sake of getting some advantage out of a disadvantageous purchase. It is well known that the law is thus misused for mean and dishonest attempts, and that its delays and ruinous cost are utilized as a means of unfair pressure in order to elicit concessions.

Cases in point could probably be cited by any engineering contractor, and would be multiplied indefinitely by the experience of other trades and professions. There are probably few firms of contracting engineers who have not undergone experiences of this character, and have, after the experience of one of two suits, wasteful alike of their time and money, brought themselves to bear with almost any material loss rather than fight with unscrupulous opponents, backed by the uncertain results of an ill-developed law and the ponderous unmanageability of its procedure. To the engineering contractor, standing as he does, between the owner and the manufacturer, and depending upon the willingness, not only of his own employees, but on their agreement with those of other trades, these remarks apply in full force, and the hopelessness of his position must excite pity, when—through no fault of his own, nay, even sometimes as a result of his praiseworthy anxiety to do justice to himself and his customer—he finds himself a loser by enforced deductions, penalties, loss of clients, or by being compelled to hold what he has purchased for his contract work, after his customers have declined its acceptance.

A contract containing, as most steam heating contracts do, a rigidly fixed date by which the work must be completed, should only be accepted with the condition that all other work shall be advanced proportionately and regularly. It is now frequently demanded that the contractor shall provide overtime and night work if required to complete his entire work by the due date. The judgment of some experienced and technical person should be required as a referee to decide on the spot when such work is necessary or whether it has been caused by the delay of the contractor or of others. The provisions of the "Uniform Contract" in this respect are one-sided and unsatisfactory.

A Low Pressure Hot Water Heating System Receiving Heat From a Steam Boiler.

Read by John Gormly, before the American Society of Heating and Ventilating Engineers.

INQUIRIES are frequently made in trade journals by parties who submit sketches of peculiar situations in which a difficulty is found in conveying heat from one location to another. In some of these cases a modification of the device here described would apparently work with success. It is not presented because of originality in design, but because it possesses some features which may be of interest.

The writer was asked to heat a three-story dwelling by direct water radiation. The only flue available was connected to a vertical tubular steam boiler which carried, irregularly, from 25 to 150 pounds of steam, on the gauge; but had at all times some steam available. This boiler was in position in the basement of the dwelling, and was used in the interesting process of manufacturing pure country milk without the intervention of a cow.

The basement was but 6 feet high, in the clear, the water line of the steam boiler was within 18 inches of the basement ceiling. All radiation was to be located upon three floors above the basement.

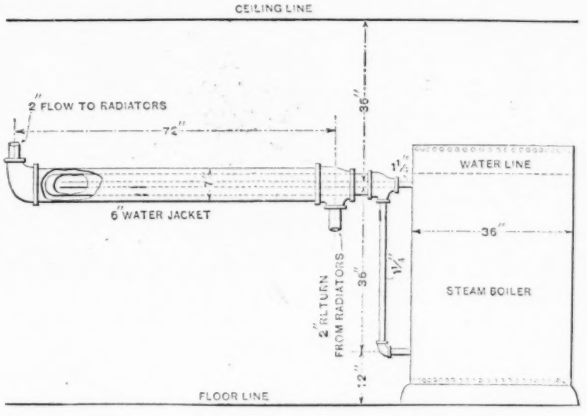
Our first idea was to make a steam jacket through which the water for radiation could pass, and in passing, could absorb heat from steam admitted from the boiler into the jacket. The condensation was to be carried back by gravity to the boiler.

We had doubts, being so close to the water line of the boiler, that the jacket would fill with condensation, especially for the reason that the largest opening on the steam boiler was but 1¼ inch and could not be enlarged because the strengthening piece within the shell of the steam boiler was already too small and would not stand an enlargement of the tap. The owner was not disposed to spend money that could be avoided, so we used the outlets as we found them.

When we turned steam on to the jacket it worked well for twenty-four hours and then turned cold. It was also noisy before turning cold. We found it apparently almost filled with condensation.

Because it had worked, apparently all right, for many hours, when the condensation was greatest, we now thought the automatic air valve was the cause of the flooding of the steam jacket. We changed the pattern of auto-

matic valve in use several times. We then placed a hand valve instead of an automatic valve. We also took the precaution to leave it a little open all the time. It worked about twenty-four hours and then was flooded. We were convinced now that we were too close to the water line.



We theorized that the water in the steam boiler was as hot as the steam. We could not elevate, but could depress, our jacket. We therefore dropped the jacket below the water line of the steam boiler and made a water jacket of it. We connected a 1¼-inch pipe circuit between the boiler and the jacket below the water line of the boiler.

When we fired up with this arangement it heated apparently as well as the steam jacket did at first. It is now in use six winters and gives entire satisfaction. We did not suppose the water circulation would be swift in the jacket, because the return pipe is but 3 feet above the base of the steam boiler, giving a head of 3 feet to cause circulation. In the haste to connect up, and give heat, three 90-degree ells were placed in each connection between the boiler and the jacket. These necessarily retard the circulation to a certain extent.

I will endeavor to describe the steam jacket which was not successful, and the modification of the steam jacket which is a success.

The steam jacket was formed of three pipes, placed one within the other, concentrically. The outer pipe, to form the shell, is 6 inches in diameter and 6 feet long. It is placed horizontally with a 2-inch outlet upon the top near one end and a 2-inch outlet upon the bottom near the other end. These outlets are connected to the flow and return main of the radiating circuit. Because the outlets are on opposite ends of the jacket, all water of the radiating circuit must pass entirely through the heated chamber of the jacket.

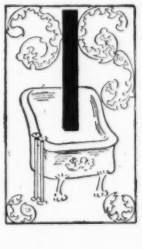
Within the 6-inch shell of the jacket above described we insert a 4-inch pipe with one end capped tight. The space, an annular ring, between the 4-inch pipe and the 6-inch jacket, is filled with the water of the radiation circuit. The interior of the 4-inch pipe, already described, is our steam space. The 4-inch pipe extends into the 6-inch jacket as far as possible, allowing room for expansion of the 4-inch pipe. The other end of the 4-inch pipe protrudes from the 6-inch pipe and terminates in a tee fitting. The 1¼-inch circulation pipe between the boiler and the jacket is connected to the tee fitting already mentioned. An air tube extends from the tee fitting to the extreme end of the inside of the 4-inch pipe. The outer end of this air pipe is connected to an automatic air valve. We placed the automatic valve a foot away from the jacket so that convected heat might not close the valve.

To change this steam jacket to a water jacket, we used the same 4-inch and 6-inch pipes, but in place of the automatic air valve and the air tube shown in thesketch, we placed a sheet metal diaphragm to insure an interior circulation.

The dwelling supplied by heat contains 393 square feet of direct water radiation, which, with the exposed mains added, amounts to 491 square feet of direct water radiation. The dwelling contains 12,699 cubic feet of space, 344 square feet of glass, and 1,147 square feet of exposed brick wall. It is three stories and a basement in height, and is well heated now with a water circulation, which is supplied through a 1¼-inch circuit between the boiler and the jacket. We think the results remarkable, as the return circulation pipe, between the boiler and the jacket, has only an elevation of 36 inches, and is extremely small for the work it does.

Proportioning Hot Water Radiation in Combination Systems of Hot Air and Hot Water Heating.

Read by R. C. Carpenter, before the American Society of Heating and Ventilating Engineers.



IN the construction of heating systems where hot water radiation is combined with hot air, warmed by a furnace, much difficulty has been experienced in securing the proper proportions of the two systems. In many of the plants which have been erected much trouble has been experienced due to the fact that the heat which is generated by the coal is not distributed as required to the various portions of the building, and that either the hot air portion or the hot water portion took an undue part of the total heat.

Judging from my own experience, which has certainly not been extensive in this line of work, the hot water radiation is usually insufficient in amount to radiate all the heat taken up by the hot water fixture in the furnace, the result being that when the furnace is crowded, the hot water in the radiators may boil and give off steam, and in so doing create a considerable amount of disturbance. In the combination systems of hot water and furnace heating it appears to be customary to use a hot air furnace of the ordinary construction, which is modified by inserting a cast iron vessel or a coil of iron pipe in which the water of the system is warmed. A system in ordinary use is

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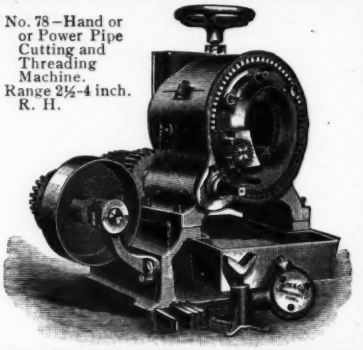

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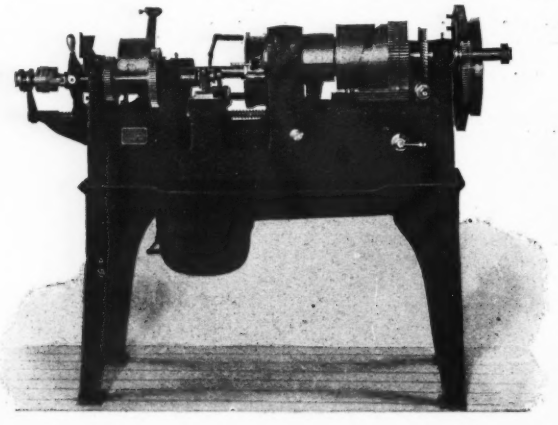
a hot air furnace with a hot water supplement and belongs rather more closely to the realm of furnace heating than to hot water heating. I have found it a matter of great difficulty to secure any accurate data on the relative amount of water heating to fire heating surface which should be placed in a hot air furnace in order to give satisfactory results. I have also found from sorry experience that the data furnished by the furnace makers for proportioning the radiation which will be carried by a hot water attachment placed in the furnace is altogether unreliable and in many cases positively misleading. I presume many of the members of the Society can give a considerable amount of reliable data on this subject, and if so I am in hopes that much information will be gathered as the result of the small amount which I volunteer. I shall present in a brief form results of some experiments in proportioning heating surface in a hot air furnace to hot water radiation and an accurate test of the efficiency of the different parts of a furnace and combined with a hot water heater.

My first experience in supplementing the power of a hot air furnace by the addition of a certain amount of hot water radiation was many years ago. The furnace specially used at that time being one adapted for long sticks of wood fuel. In this particular case it was required to warm up a certain portion of the building which was not heated by the hot air and the problem was simply the balancing of the heating surface in the furnace with that of the radiating surface in the building. It was decided to insert a circulating coil of wrought iron pipe into the furnace to supply the necessary heating surface, which was made of 1½-inch pipe extending completely around the furnace directly above the fire box. In this particular instance the amount of radiation installed was 150 square feet. Every authority at hand was consulted in order to determine the amount of heating surface before constructing the furnace coil. The best authorities semed to indicate that for each square foot of radiation there should be supplied one-third of a square foot of heating surface, and in constructing the coil it was made on this proportion. The results of this experiment, while it seems rather funny at the present time, was at the moment rather serious. After completing the work fire was started in the furnace, the workmen left and everything was apparently in the finest condition; in fact, such was the case when I went to bed. In the middle of the night I was awakened and requested to come immediately to the house in question, because the furnace was groaning and there was such an internal pounding and such an infernal noise that it was believed the apparatus would explode The only remedy which I could suggest was to let the fire go down and to keep it low until some of the heating surface could be removed from the furnace. The authorities consulted had evidently been very much in error, or at least their advice was not applicable to a wood furnace. The heating surface was reduced a little at a time until it was finally brought to the proper pro-



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portion, in which case it was only ten per cent of that first installed. The final ratio which proved satisfactory in a wood furnace was one square foot of heating surface in the furnace to 30 square feet in the radiator.

A later experience with the application of a hot water heating system to a hot air furnace also required a number of trials before the combined system was a success. In this particular case the furnace was a coal burning furnace with grate 20 inches in diameter, which had been installed for some years. The furnace failing to heat all parts of the house, it was decided to install a sufficient amount of hot water radiation to make up the deficiency and to obtain the heat for warming the water in the radiators, a cast iron vessel was to be located in the upper part of the furnace and directly above the grate. The cast iron vessel, especially made, was supplied by the maker of the hot air furnace and was provided with a very deep conical bottom, and located as shown in the sketch, Fig. 1, its bottom being 20 inches above the grate. The return water was arranged to enter into the bottom of the vessel by two branches, the flow to pass from the top through a 2-inch pipe. The total heating surface in the cast iron vessel, as measured, was 6.6 square feet, in the connecting piping inside the furnace was 2 square feet, making a total of 8.6 square feet, of which about one-half was exposed to the direct radiant heat of the furnace fire and the other portion well situated for receiving heat. The hot air furnace contained approximately 65 square feet of surface for heating air and 2.2 square feet of grate. Learning wisdom from my previous experience in this kind of work, I decided to put on a sufficient amount of radiation to absorb all the heat taken up by the heating surface, and with this end in view I attached 255 square feet of radiation in the form of cast iron radiators and 30 square feet in the shape of uncovered connecting pipes, making a total of 285 square feet. This amount was fully double that advised by the maker of the hot water heating appliance. The results of the first trial were unsatisfactory for an entirely different reason from that previously mentioned, namely, that the radiators did not get sufficient heat to keep them at a temperature sufficiently high to warm the rooms. An investigation showed that the chimney from the furnace was extremely hot when a good fire was maintained, and that consequently a large proportion of the heat which should have been used in warming the building was passing up the chimney. The system was in effect a failure, as it did not warm the building, nor was it economical. I then decided to locate a radiator on the return pipe near the furnace and construct my smoke flue around this radiator in such a manner as to absorb so much of the chimney heat as possible. A thin radiator containing 15 square feet of heating surface was supported in a horizontal position and a smoke box of the horizontal dimensions of the radiator, and five inches deep was connected to one end of the furnace, and at the other end to the chimney; some baffle plates were put in to drive the heated gases over the radiator. This was a success so far as keeping the heat out of the chimney was concerned and its results at the end of the year showed a saving in fuel of fully one-third as compared with the previous two years. A practical trial, however, showed many defects in my economizer. The smoke flue was too cramped, and at the end of the second year the radiator had become so badly encrusted with soot that the passage to the chimney was nearly choked. The effect was also seen in the diminished heating power of the system. I reconstructed the economizer, taking pains to correct any faults which had appeared from two years of use. In its reconstructed form I used a flat radiator containing 22½ square feet and constructed around this a galvanized iron casing 4 feet by 2 feet 3 inches in horizontal dimensions and 9 inches deep. I also provided ample doors for cleaning. In this construction I made no effort to drive the heated gases over or through the radiator, but simply suspended the radiator in the upper part of the casing where it would naturally received the highest heat of these gases. The results with this arrangement have been highly satisfactory, and the relative proportions of hot water heating surface and hot air heating surface seem now to be as nearly correct as possible. The return from all but 100 square feet of the radiating surface passes through the economizer and in so doing is usually warmed about 7 degrees, although in some instances as high as 15. The ratio of hot water heating surface to hot water radiation is as 1 to 38, which is not essentially different from that found to be necessary in the case of the wood furnace. In computing this ratio the indirect heating surface in the smoke flue is not taken into account. If this be taken into account the ratio is as 1 to 9.2, which approximates that of the ordinary hot water heater.

The rise in temperature of water caused by the principal heating surface is about as follows when outside temperature is 22 degrees, inside temperature 70 degrees, temperature of water in radiator 140 degrees, temperature of return water entering main heater from economizer 116 degrees, temperature of water entering supplementary heater 109 degrees, discharge from heater 145 degrees. Water in main return 109 degrees, temperature exhaust gases 225 degrees.

The following shows in tabular form the dimensions of the various rooms and the method of heating, with dimensions of radiators.

Although there is a downward current with about 1 foot 6 inches head from economizer to the lowest point of heater, there has been no difficulty with the circulation.

During the past year I had an opportunity of testing a combination hot air and hot water heater under conditions which permitted an exact measurement of the heat given off by each system of heating. In this heater the hot air was all discharged through a single pipe 9¼ inches in diameter. The grate was circular 21 inches in diameter. The heating surface for hot water consisted of 21 feet of 1½-inch pipe coiled spirally around the fire box, thus giving 10.29 square feet of heating surface; the ratio of heating to grate surface was 4.29, the area of discharge for hot air was 0.466 square feet. In order to measure the capacity of the heater two tanks were arranged vertically over the heater at a height of about 20 feet, one of these tanks was connected with the flow pipe from the heater, the other with the return. Water was withdrawn in small amounts at regular intervals from the tank connected with the flow and a corresponding amount reduced

in temperature as desired was added to the return tank; by this method the exact amount of heat absorbed could be accurately measured and an artificial circulation was produced. The level of the water in the tanks was kept essentially constant during the test. The exact temperature of the water in the discharge and return was read by thermometers inserted near the heater.

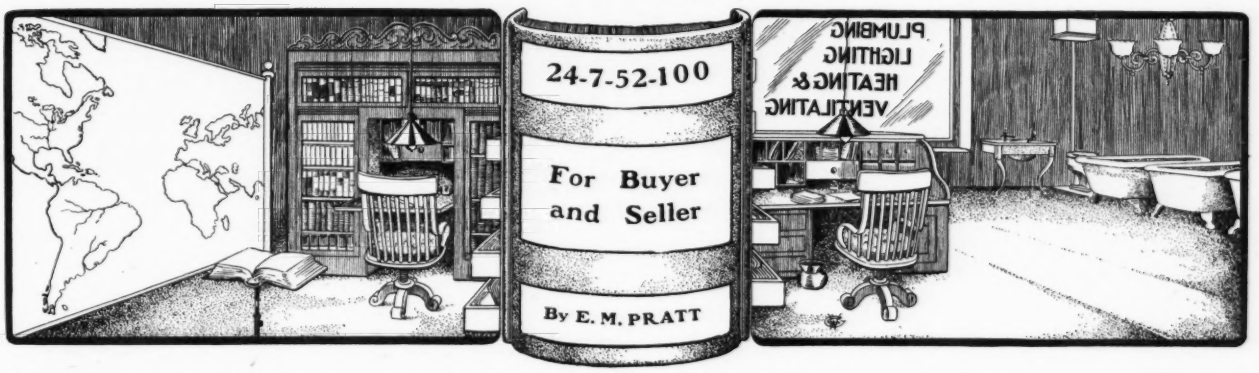
The air issuing from the discharge flue was computed by measuring the velocity and temperature, computing the volume and multiplying this by the weight of a cubic foot of air under similar conditions. The coal burned during the test was also measured. The tests were made, the results of which were recorded in the tabular form directly following these remarks. In the first test the rate of circulation was somewhat less than in the second and the heat units absorbed per minute show a corresponding reduction. In the first test, coal was burned at the rate of 2.76 pounds per square foot of grate surface per hour, and of this heat about 70.7 per cent was absorbed in heating the air and water. The air taking up nearly 50 per cent more than the water. In the second test 6.11 pounds of coal were burned per square foot of grate per hour, the total efficiency being somewhat less than 40 per cent. In this test the heat absorbed by the water was about 1-6 greater than that absorbed by the air.

Considering the amount of heat as given off by one square foot of hot water radiating surface as 200 B. T. U. per hour, which is approximately correct, under conditions of coldest weather, we compute the amount of radiating surface which will be supplied under usual conditions by each test by dividing the total heat absorbed by the water by 200.

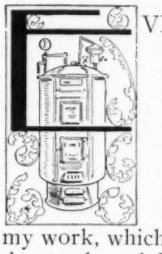
From these tests made under different conditions it would seem that the combination system of hot water heating in connection with a furnace does not preserve a uniform ratio of performance in the operation of the various portions. The hot air system takes up the greater portion of the heat for a smaller consumption of coal than for a larger, from which it would seem that the portions of a building warmed by the hot air would receive more than the proper proportion of heat during comparatively mild weather and at times when the hardest firing must be practiced. This would also indicate that it is difficult to keep two systems such as hot water and hot air balanced for all conditions of firing. The reason for this is probably due to the fact that the absorptive capacity for heat of the two substances, water and air, obey different laws and that the conditions which render the one most active are not so favorable for the other.

	JUNE	
	1st	2nd.
Mean delivery of water lbs. per minute	10.75	14.00
Mean difference in temperature between inflowing and outflowing water.....	42.69	53.0
Time of run in minutes.....	2.45	180
Net coal burned during this time.....	27	44.0
B. T. U. supplied per minute.....	1571	3470
Coal burned per square foot grate surface per hour.....	2.76	6.11
B. T. U. absorbed by the water heating system, per minute (10.75 x 42.69).....	459	7420
B. T. U. absorbed per minute per square foot of heating surface	44.60	75.2
AIR		
Average velocity of air through heater per minute.....	463	534
Average difference of inflowing and outflowing air.....	25044	27260
Cubic feet of free air per minute.....	215.8	247.5
Weight of cubic foot of air at this temperature and pressure.....	.050	.0402
Pounds of air per minute.....	10.79	9.94
B. T. U. absorbed by air and water systems per minute	1112.00	1386.0
B. T. U. supplied per minute.....	1571.0	3470.0
Efficiency of furnace a—b.....	70.7	39.9
Square feet of radiation for 200 B. T. U.....	137.7	222.6

First Story. 9 ft. high rooms.	Dimensions	No.	Windows area.	Exposed walls.	Cubic feet.	Radiation sq. ft.
Parlor.....	14 x 15	2	74	261	1890	Hot Air
Dining Room.....	15½ x 11½	4	89	126	1880	" "
Sitting Room.....	14½ x 16	2	56	144	2100	" "
Hall	16 x 7	2	112	162	1108	Air & 37.5
Bed Room.....	9 x 12	1	20	108	972	21
Kitchen	12 x 15	2	40	108	1615	No heat
Second Story. 8 ft. high						
Study	15 x 14	3	54	232	1690	Air & 50
Bed Room	14 x 14	2	30	112	1572	Hot air
Bath Room.....	10 x 7	1	20	126	560	" "
Alcove	8 x 10	1	30	144	640	No heat
Hall	20 x 30	1	20	72	672	" "
Bed Room	13 x 10	3	60	80	1040	Hot air
" "	7 x 10	1	20	64	560	22.5
Back Hall.....	6 x 14	1	20	160	672	22.5
Third Story						
Bed Room.....	29 x 10	2	16	250	2030	100
				TOTAL	18004	



Let the big book of drawers full of envelopes represent the medium between you and me. Imagine that the drawers slide both ways and that the envelopes are alphabetically indexed on both sides. My work is to go into all the world to collect better personal, professional and commercial methods useful to you in your work during the day, the week, the year, the century. This page is for the exchange of questions, answers and experiences.



EVERY person has a question of some kind awaiting an answer, but when you ask any one abruptly for one, none is likely to be around handy. You and I are just like other people on this subject. There are exceptions—an occasional man has a ready reply to, "What do you want to know?"—the standard question of the Registration League, another department of my work, which is trying to collect ten thousand questions. A postal card full of questions from you would be gratefully accepted as a contribution. Last month my collection received a scrap book of valuable articles from a Chicago musician.

* * * *

IF you were to draw a chart of your personal forces, how would it look?

Are you long on memory and short on estimating? I asked a country editor what he could do the best of anything he had tried, and he said estimating the price of job printing. I know of men who have rattled their bank book by errors in estimating work.

Suppose you are long on accuracy and short on making friends—what are you going to do about it?

You might find a partner who is short on accuracy and long on making friends. Or you might begin studying how friends are made.

An army officer gave me an illustration of how treacherous a man's memory can be. He rented his farm to a party and then let him have some money for a few months.

The officer told me one day on a train that he would have taken oath that the money was due in September. In place of debating over it the renter of the farm suggested that they get out the papers and see the date. They did and it read October.

A man sent his father-in-law to me to learn the particulars about a bargain of a building lot which he thought I had told him was for sale. I could not recall the conversation and suggested that some other person might have informed him.

For weeks the son-in-law believed that I was wrong. but one morning the man who had told him about the lot came on the train and then the son-in-law remembered it all.

Important transactions cannot be too carefully recorded. Those who distrust themselves are sometimes the most reliable. It is folly to discuss something you are not sure about when you can get the facts and know.

Having to pay money the second time is one of the most irritating things on record, and all of us very well know that a correct record prevents such trouble A man told me he had occasion to use a receipt which he had had on file for eleven years.

HE knows more than he has time and strength to apply at the right time.

During a train talk the other day he told me he wished he could become more systematic and have more executive discrimination.

He saves things he thinks he may need later till he is nearly crowded out of his place of business, and he lacks nerve to arise, shake off and escape the enslaving inanimates.

He has a good many good things in his head and in his desk to put into practice, but he does not boss his time enough to start the ideas and manage them.

During February and March of this year I am trying to think of something useful to him—or find a story which will help him do as well as he knows he should do.

The work I am on for him is not so very easy. My experience is such that I am likely to profit as much as he is if I get a helpful hint for him.

Recently I removed from the door of the medicine cupboard in our bathroom a piece of paper having two large letters on it. I pinned it up months ago to help myself remember to do as well as I knew how. But it did not help me very much, if any. I needed something to help me remember the two letters on the door.

Will power culture is something in which I have some faith yet. Set apart a few minutes a day and practice doing something in such a way as you would like to be able to do everything all the time. This applies to system, application or any acquisition.

There is a railroad president whom I occasionally pass on the streets and always admire for his elastic step. When tired out, yet going, I feel that my gait is the antithesis of his. But from the tests which I have made of a few minutes a day of physical culture, I think it possible for me to greatly improve my walking. And from what I know of the will power culture of others, I believe it is possible for any person to gain much by a few minutes' daily practice. One man increased his power to concentrate by daily exercises of thinking of only some one thing for five minutes. An editor who is called to his telephone several times during the night is able by practice to go to sleep almost instantly by loking at the door knob and thinking of nothing.

* * * *

Good business methods are products of strength, a knowledge of values and of well-formed habits. The man who might gain by loose methods is to-day insisting on correct transactions, that there may be no time-consuming and reputation-scratching complications. The business world is hastening the time when all things shall be revealed and done right.

Causes of Commercial Non-Success.

I—A Lax Credit System.

THE statistics of business failures have for the student of commercial conditions as vital an interst as have the mortality tables for the insurance expert. They are the basis for his computations of probability and chance. The actuary studies his tables and determines the risk he is taking by insuring a client at a given age. The business man studies the records of business failures and computes the limit of credit which may be extended to a customer under a given set of circumstances.

In each case there is a personal equation to be taken into the consideration. The insurance man inquires into the physical condition of the applicant and makes diligent research into his antecedents before declaring him an insurable risk. The good business man should learn everything possible of a petitioner for credit, not only his present financial status, but his business habits, manner of life, previous record, and, if possible, the facts of his family's business history. This last may seem to be carrying caution to the extreme, but expert credit men give their testimony that a tendency to fraudulent failure seems to be transmitted in some families just as consumption or insanity is in others.

It is surprising that the business world has so long tolerated haphazard methods in this most important branch of the body commercial. The secret of this laxity is undoubtedly to be found in the willingness to take a risk in order to gain a new customer or prevent the losing of an old one. The customer, under the present system, so long as he can keep up the outward appearance of solvency, resents any effort on the part of the firm of whom he buys his goods to "pry into" his affairs, and, if the effort is persisted in, threatens to give his patronage to another house, knowing that there are plenty who will extend credit because of their desire to enlarge their patronage.

What is needed is a campaign of education which will bring both buyer and seller up to a better realization of the principles involved in the credit system. In the first place, the buyer must be taught to recognize the fact that in asking the seller to let him have goods on time he is asking him for the loan of the equivalent of cold cash. Let the metallic clink be heard ever so faintly and both parties to a transaction are at once alive to the realities of business. The traveling salesman rightly advances the firm's reputation for courtesy and liberality; the credit man, while a model of courtesy, should guard the firm's reputation for doing business on a strictly business basis.

Let him insist that the applicant for credit make as clear a statement of his financial condition to him as he would make to the friend to whom he would go for a money loan. In the latter case he would voluntarily offer an explanation of the causes which necessitate his asking the loan; he would assure his friend of the safety of his money if entrusted to him, and offer to protect him with an indorsed note. But when the credit man asks him for a simple statement of his solvency he goes away in a childish huff and transfers his patronage to a firm which is not so "suspicious." It is to be doubted whether the latter firm is to be congratulated upon the accession of its new and doubtful customer.

The education of the seller should be in the direction of greater conservatism in credit giving. When the great body of sellers shall have been educated up to the point of insisting that not even the desire to camp in another's bailiwick will induce them to grant credit until perfectly satisfied as to the worthiness of the petitioner for credit, then we will hear less of fraudulent failures and it will be impossible for such an event as the recent Strong failure to occur, because creditors will let no outward appearance of prosperity cover recognized laxity of business methods in the interior working of the concern. Business will have to be transacted openly and above board, or credits will not be extended.

Finally, let the seller realize that a well-known conservatism in granting credits is a realizable asset. Enterprise, push, a desire to get everything in sight are all very commendable, but the house which is known to do business on a conservative basis will find its own credit rating A No. 1 sooner than will the house which is known to take big risks for the sake of a big volume of business.

In the preceding paragraphs the effort has been to define certain recognized principles which should govern all credit asking and giving. Next week we will again take up the subject and treat it more in particular, endeavoring to get at the chief causes of business failures and how they are encouraged rather than prevented by the present system.

II.—Lack of Ability.

TO say that business ability is an indispensable prerequisite to business success would seem to be a truth so self-evident as to be almost a truism, and yet one has only to look over the rank and file of business men to realize that a considerable fraction of them are manifestly unfitted to occupy the positions they have assumed. Indeed, the statistics of business failures show that a very large percentage of failures are due to the reckless ventures of men who are in no way equipped for a business career.

Business ability is two-fold in its origin. It is composed of inherited instinct and acquired habit. It is hardly too much to say that the ideal business man, like the poet, is born, not made. The commercial instinct is a kind of inspiration, and a Carnegie, an Armour, or a

Rockefeller will as inevitably become a great captain of industry as a Shakespeare or a Milton will become pre-eminent in the world of letters. Their genius for business is a natural endowment, undoubtedly enhanced by careful cultivation, but originally a gift, just as is a genius for art or music.

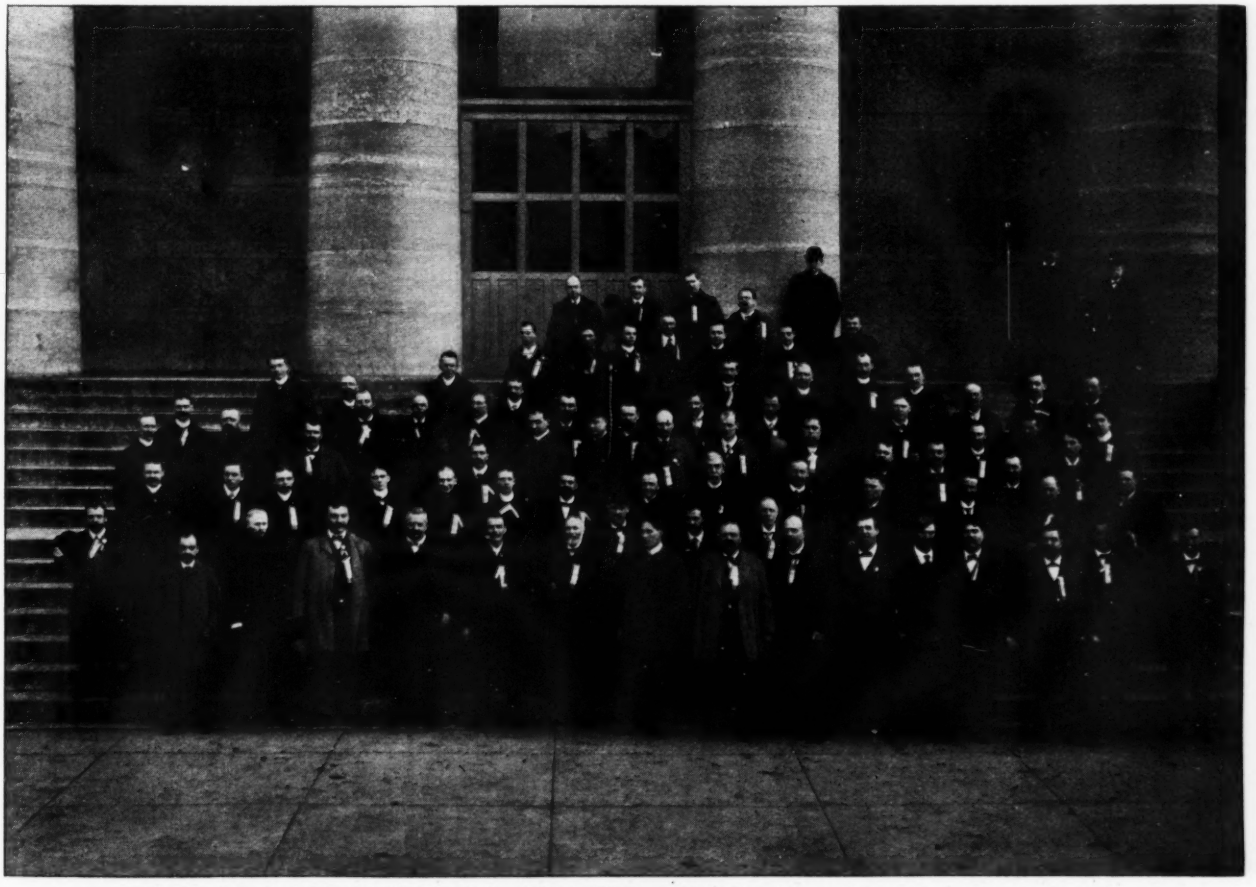
That one may attain, by careful application, considerable success with a very meagre endowment of natural ability is again as true in business as it is in art. But to expect that a man can be anything but a failure in business who is utterly lacking in the commercial instinct, is as unreasonable as to expect that a man can follow successfully a musical career who has no ear for music.

To define the term commercial instinct would involve too lengthy a discussion for the limits of the present paper. Just wherein the secret of success lies is a much mooted question. Perhaps it is not to be found in any one characteristic. Men who have attained success differ widely in their theories as to how they have accomplished it, but on certain things they all agree. One cannot attain success who has not will power, self-control, industry, perseverance, etc. In other words, a man must first be master of himself if he would be a master of men. Initiative—an ability to originate and carry out plans, is also an indispensable part of the business man's equipment.

As a class inventors are of all men most prone to force their way into the great game of business without an adequate conception of the meaning of the game. The very characteristics which make them inventors unfit them for a business career, and the number of inventors who have successfully launched and managed companies for the manufacture of their own inventions is but an infinitesimal fraction of those who have made the attempt.

When the millennium shall have come and each man shall be endowed with knowledge of his own capabilities and limitations and shall, moreover, have the opportunity to do the thing for which he is fitted, and no temptation to do anything else, we shall see fewer square pegs in round holes. As it is, the business community must take care of these business incompetents, just as society takes care of its incompetents—grudgingly, but of necessity.

But if a man is in a measure excusable for overestimating his own natural capabilities, there can be little excuse for the one who enters the field without the equipment which it is perfectly possible for him to acquire. It is not asking too much of a man who is to be extended the credits and courtesies of the business community to insist that he have a knowledge of the first principles of business, such a knowledge as may be gained in any of the excellent commercial schools of the country if one is too impatient to learn in the school of actual experience. And let a man give proof not only of his knowledge of business usages but his habitual observance of them.



A Group of Members of the Ohio State Association of Master Plumbers at their Annual Convention at Columbus, on February 19-20.
Photo by Baker Art Co., Columbus, O.

Items of Interest.

SANITARY WARE IN FRANCE.

An English correspondent writing to The Iron Age says: A firm has recently started business in Paris for the sale of sanitary ware of British, American and German manufacture. British firms are not directly represented, but British goods are bought through a Hamburg house, shipped to Hamburg and completed with German fittings. The company in question have alarge show room in which they exhibit lavatories, baths, flush cisterns, fittings and sanitary appliances of all kinds, making aspecialty

of installations for hospitals. The taps, pipes and connections are of German make and are light and nickel plated. The enameled iron baths are also German. The only American goods shown are those manufactured by the Trenton Pottery Co., of Trenton, N. J. They are mostly porcelain baths and lavatories, but the metal fittings are German. The difficulty seems to be to induce the architects to specify the particular goods shown by this company. I imagine that plumbing and sanitary ware made in America can hold its own with German on neutral territory.

Acetylene Gas in Germany.

According to the report of Dr. F. Rose, British consul at Stuttgart, acetylene gas is growing in favor in Germany. He reports that in Europe over 120,000 H. P. is devoted to the manufacture of calcium carbide, and at the present time Germany has 200,000 acetylene gas jets installed. German capital is being invested in its manufacture in Norway and Switzerland and other foreign countries.

A Beautiful Map Free.

Everybody reading this item who is in any way connected with the lines of business covered by Domestic Engineering should immediately drop a postal card to the J. L. Mott Iron Works, New York City, and receive by return mail one of the handsomest maps of the United States seen in many a day. These maps are about 3 feet square, printed in colors, with the recent census population of each state printed in red numerals across the state, and will make not only a very valuable up-to-date map of the entire United States, but, in addition, will be seen at a glance the population of each state according to the census of 1900.

Opportunities for American Plumbers.

Julian Ralph has the following to say about the opening for American plumbing goods in England:

"There is an immense movement in the building of flats in London, and no matter how handsomely these apartments are appointed otherwise, they all fall down when it comes to the plumbing work. An American bathroom of the first order is like a bit of jewelry, but the English are still making clumsy piping, unsightly baths and antediluvian faucets and connections.

"The apartment house builders, who are all trying to vie with one another in securing the most attractive appointments, will buy American fittings if they once see them and are impressed by their beauty and sanitary excellence. Moreover, England is full of the palatial private homes of men who want the best and are willing to pay for it. I feel certain that a shop on Regent or Bond street, displaying the best toilet and bathroom work, of which we are the undisputed makers, would lead to such a revolution in favor of American plumbing as has been effected by Yankee shoes, typewriters, elevators and a hundred other sorts of goods. I know of one Englishman who came back from a visit to the United States vowing that he would get the most attractive home in London merely by putting American plumbing into it."

Absolutely Free.

The Wisconsin Graphite Company, of Pittsburg, are in the market as general Eastern selling agents for the Portage County Graphite and Mineral Paint Mfg. Co., of Stevens Point, Wis., and are making a specialty of a Graphite pipe joint paste, an article meeting with the approval of the trade. A special feature of this paste is that it can be had in small self-sealing cans for use of the plumbing trade. Journeymen, as a rule, will take a pound package, and while using but a small portion invariably leave the balance on the premises where they have been working, because they want to avoid smearing their kits and tools. By using the self-sealing can this is avoided and more than one-half the product is thus saved. A sample will be sent free to all readers of "Domestic Engineering" upon request. Write for one, it is worth trying, to the Wisconsin Graphite Co., No. 400 Market street, Pittsburg, Pa.

European Sanitation Methods.

Foreign and American methods of sanitation were contrasted by Professor William T. Sedgwick, in a paper recently read before the Twentieth Century Club, of Boston, on "Important Movements in Europe in Behalf of Public Health." He said that Americans are coming every day more and more to follow European, and especially English, methods, for the same reason that led to their adoption there, because we are becoming crowded. In England questions of sanitation have compelled attention for many years, and by agitation a public sentiment has been created which sustains the lawmaker. Germany has become fairly well advanced in sanitation, always following English models. France and Italy still eave much to be desired, except where the tastes of English tourists have to be consulted. In on foreign country, however, except England, is there a public sentiment sustaining radical sanitary legislation.

In sewage disposal, English municipalities are wedded to the "contact" system, the retention of sewage for several hours in tanks where the bacteria may perform work under pressure. London sewage is still the greatest sanitary problem of modern times, and is by no means solved. The Massachusetts state experiment station at Lawrence, has little, however, to learn from English sources. In water supply the English have gone a long step in advance of us in guarding their rivers from pollution. The Thames, particularly, though flowing through a thickly populated region, is a clear, pure stream, thanks to the conservancy board. American rivers must be dealt with in a similar manner some time. In garbage disposal, Europe also has a different problem, largely through the difference in character of the ashes. Boston, however, is handling the matter most intelligently. Where Europe, and particularly England, is distinctly in advance of this country is in sanitary administration. The principle everywhere is in favor of a central board of extensive powers, supervising local boards. The local-government board in England, composed of some of the very highest officials in the realm, has not only advisory powers, but the ability to enforce sanitary statutes.

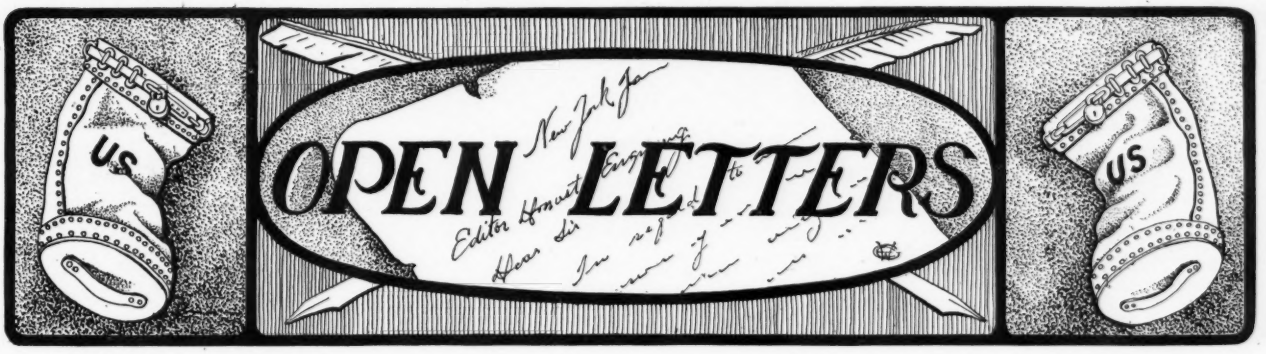
Proposed Experimental Septic Tank.

The desirability of some purification of the sewage of Washington University new location of that institution suggests to Professor Van Ornum the propriety of arranging the tanks and apparatus in such manner that experiments may be carried on with the purpose of working out the details of the operations and further developing the principles upon which the work of the septic tank is based.

In a paper on the subject recently presented to the Board of Directors of the university, Professor Van Ornum gives quite a full statement of the present understanding regarding the processes of sewage purification in which the septic tank is a step, and proposes a plan for the experimental tanks and apparatus. The actual first construction will cost comparatively little in addition to the necessary outlay for a purification plant equal to the best according to our present knowledge. The real expense will be in making desired reconstruction for experiments, the plans for which will develop as the work goes on. There will be, also, a considerable expense in carrying on the daily routine of examinations, much of which can probably be charged to the department of instruction in the university since it may be made to form an important item in the training of students in some departments.

It is very desirable that such an experimental plant be established, and if the university board can see its way to appropriating the necessary money from time to time it will be doing a service to sanitary science and at the same time placing the university high on the record of promoters of scientific investigation.

In this connection attention should be called to the experiments on septic tank action in progress under the direction of the Massachusetts State Board of Health. Some account of the work in 1899 as reported upon in the last annual volume issued by the board will be found in our columns next month.—Municipal Engineering.

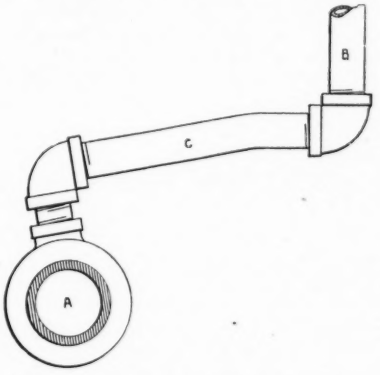


TROUBLE WITH A STEAM JOB.

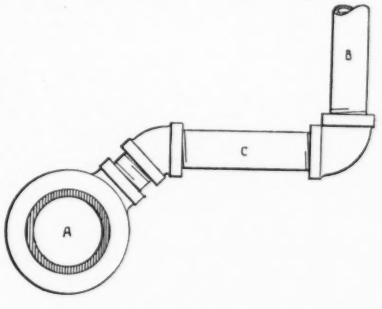
Altoona, Pa.—To the Editor of "Domestic Engineering," Sir:—We are having trouble with a steam job we have put in, of which we enclose a rough sketch. Will you have the kindness to tell us what the trouble is?

ANSWER.

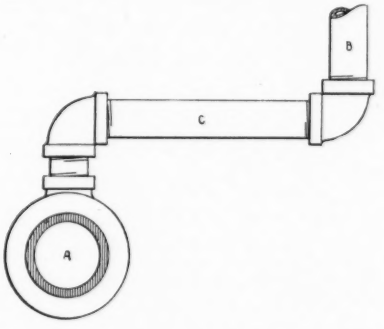
From your rough sketch, which it is not necessary to reproduce, we believe



the trouble is in your rising connections. We illustrate herewith three methods of making these connections, any one of which would correct your trouble. In



Figs. 1, 2 and 3, "A" is the steam main and B is the bottom of the riser and C the connection between the steam main and the foot of the riser. These connections should be long enough to keep the main far enough away from the walls to get conveniently at the various fittings for putting them in and also to make any changes which may be required afterwards, or to cover the pipes with non-conducting material. The connecting piece, C, permits the main and the riser to expand slightly without injury to the system. Fig. 1 shows the practice sometimes carried out by steam fitters of slightly bending the connecting piece C to make good drainage possible. Fig. 3 shows the way some fitters secure drainage by cutting the thread crooked at the



right end of the connecting piece C. This is a practice which is being condemned because the die cuts too deeply in the pipe on one side, thus weakening it. Unless both of your pipes are short, it is not good practice to connect risers directly to the top of mains by tees, for the reason that if the riser is a long one, its weight will cause the main to sag, or, if the connections to the radiators above are rigid, the downward expansion will bend the pipe or lift the radiator. Connections to radiator branches, if possible, should be made with Y's. Tee connections in one pipe systems are objectionable because water of condensation flows down the entire surface of the riser and is apt to flow outward in the branch which increases the difficulty of proper drainage. In very long risers provision must be made for expansion by making horizontal offsets in the pipe at intervals not more than two stories apart, and if the weight of the riser is considerable it must be supported by some other means than by the connections to horizontal branches.

TO FIND THE WEIGHT OF CASTINGS.

Pittsburg, Pa. To the Editor of "Domestic Engineering." Sir:—We would like to know if there is any general rule for finding the weight of castings from their patterns.

ANSWER.

A rule for approximately determining from their patterns what castings made from those patterns will weigh is as follows:

Multiply the weight of the wood pattern by 17 for cast iron, 18 for brass, 19 for copper, 25 for lead.

FOR MAKING RUST CEMENT.

Birmingham, Ala. To the Editor of "Domestic Engineering." Sir: In the next number of "Domestic Engineering" would you have any objection to publishing a recipe for making cement for rust joints?

ANSWER.

If you want a quick setting cement for rust joints you may make it as follows:

One part of sal-ammoniac, by weight, 2 parts of flour of sulphur, 80 parts of iron borings.

If you want a slow setting cement use this:

Two parts sal ammoniac, one part flour of sulphur and 200 parts iron borings.

FLUXES FOR BRAZING AND SOLDERING.

San Francisco, Cal. To the Editor of "Domestic Engineering." Sir:—I would like to know where I can put my hand on the recipes for making various fluxes for brazing and soldering. Will you kindly tell me through the next issue of your valuable paper?

ANSWER.

The following is the composition of fluxes for brazing and soldering various kinds of metals:

For cast iron, malleable iron and steel the fluxes are borax and sal-ammoniac.

For copper, brass and gun metal the fluxes are: Sal-ammoniac, chloride of zinc, or resin.

For tinned iron the flux is chloride of zinc or resin.

For zinc the flux is chloride of zinc.

For pewter the flux is Gallipoli oil.

For lead with coarse solder the flux is tallow.

For lead with fine solder the flux is resin.

THINKS GASOLINE LIGHTING SAFE.

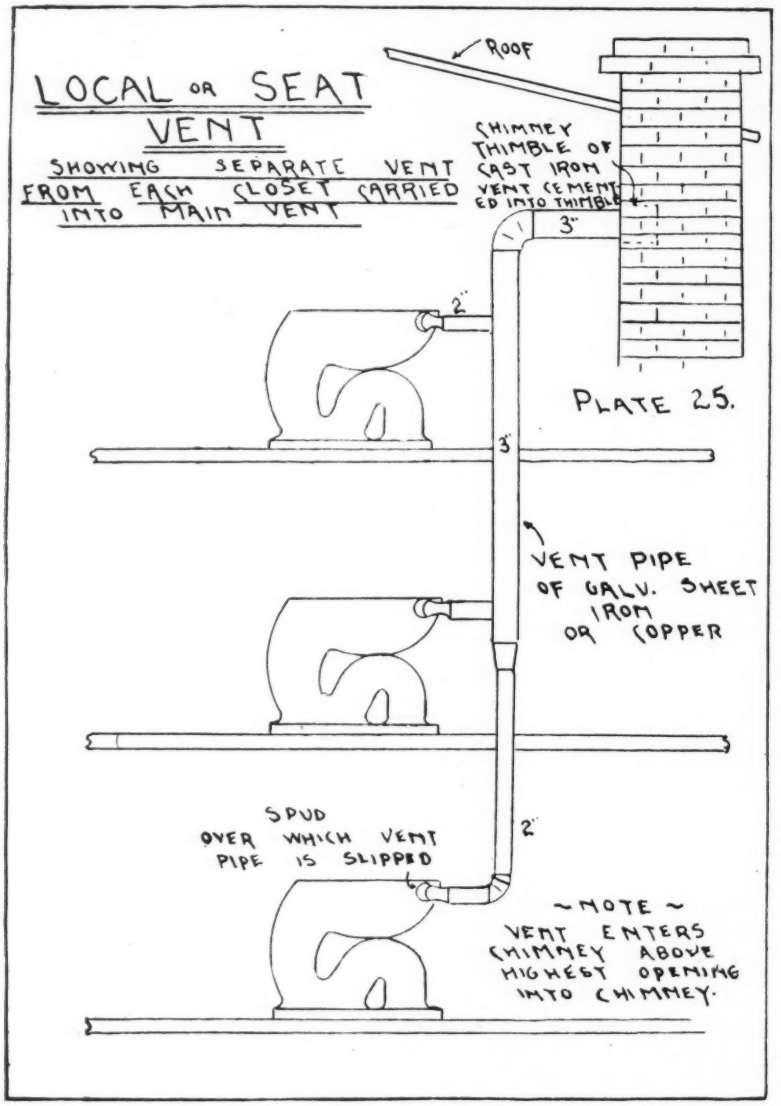
Salina, Kans., To the Editor of "Domestic Engineering," Sir: Your letter of Feb. 1 inquiring about the gasoline lamp explosion in the barber shop of my neighbor and friend, Joe Olinger, at hand. Regarding same will say that I have not had a chance until to-day to make the necessary inquiries in order

that I might do justice to Mr. Olinger and the representative of the Cincinnati Air Light Co. who installed the lighting plant.

Mr. Olinger informs me that the machine was only a sample 5-light machine made by a tinner and was not heavy and strong as the company's machine would be. When the pressure was turned on the pipes began to leak and overflow onto the show case and floor; the gasoline waste then became ignited and you can guess what followed. Now, the machine is not to be condemned, and I I think the system is safe when there are no leaks. I would not hesitate to erect one in my own house or in any place of business, but would put in the pipe with the greatest care and test it until I knew beyond any possibility of a doubt that there were no leaks, then I would consider it as safe as the old tallow candles used in the forties and fifties, and it is certainly up-to-date.

Will say that our city gas looks like a lightning bug on a Yazoo swamp beside this system of lighting. I have a contract to pipe another building for this light and will say that the slight flurry in Mr. Olinger's shop has only acted as a stimulant to have the work done well. I believe this covers all you wish to know. At any time I can serve you, command me freely. I beg to remain "Domestic Engineering's" friend.

Matt Whitson.


LOCAL OR SEAT VENT
SHOWING SEPARATE VENT FROM EACH CLOSET CARRIED INTO MAIN VENT
ROOF
CHIMNEY THIMBLE OF CAST IRON VENT CEMENTED INTO THIMBLE
3"
2"
3"
PLATE 25.
VENT PIPE OF GALV. SHEET IRON OR COPPER
SPUD OVER WHICH VENT PIPE IS SLIPPED
2"
~NOTE~
VENT ENTERS CHIMNEY ABOVE HIGHEST OPENING INTO CHIMNEY.

The Question of Seat Vents.

Audobon, Ia. To the Editor of "Domestic Engineering." Sir:—Will you have the kindness to publish in a future issue of "Domestic Engineering" a method of constructing a seat vent to a water closet?

Answer.

We answer our correspondent's question by publishing plates Nos. 25 and 26 of Starbuck's Plumbing Charts, which show two ways of constructing such vents for closets, either one of which will prove satisfactory to our subscriber.

What Should Be the Weight of Lead Joints.

New Orleans, Ia. To the Editor of "Domestic Engineering." Sir:—I have had a discussion with a journeyman plumber as to the amount of solder which should be used for making various sizes of wiped joints. Will you have the kindness to decide this dispute in the next issue of "Domestic Engineering."

Answer.

The following is a general table showing the amount of solder in pounds required to make wiped joints on pipes of the given diameters:

Diameter of pipe in inches—½, ⅝, ¾, 1¼, 2, 2½ 3, 3½, 4, 4½, 5, 6.

Solder required in pounds—¾, 1, 1, 1¼ 1½, 1¾, 2¾, 3, 3½, 4, 4½, 5.

Different workmen vary greatly in the amount of solder they leave on their joints, but the amounts named above are for good, substantial work, for resisting all pressures which are likely to come on strong pipes. For waste or vent pipes a smaller quantity than is mentioned above can be used safely. When plumbers are working in buildings a large amount of solder is unavoidably wasted and lost, and in estimating the cost of material in making joints it should be the rule to allow 5 or 10 per cent in addition to the foregoing figures.

Lengths of Wiped Joints.

Dubuque, Ia.—To the Editor of "Domestic Engineering." Sir: Will you kindly tell me how long the wiped points should be on various sizes of pipe?

Answer.

The following table will give a good working rule to our inquirer:

For 6	inch pipe.....	4 inch joints
For 5	inch pipe.....	3¾ inch joints
For 4	inch pipe.....	3½ inch joints
For 3	inch pipe.....	3½ inch joints
For 2	inch pipe.....	3¼ inch joints
For 1½	inch pipe.....	3 inch joints
For 1¼	inch pipe	3 inch joints
For 1	inch pipe.....	3 inch joints
For ¾	inch pipe.....	2¾ inch joints
For ½	inch pipe.....	2½ inch joints

Say It Is a Good Thing.

Newport News, Va., Feb. 12, 1901. To the Editor of "Domestic Engineering," Sir: We note sometime ago and also in your February 9 issue a notice of a gaso- We hope Mr. Bishop will get a patent on this. We have been using one for the last 15 years made by ourselves for our convenience. We can guarantee it does the work all right. If Mr. Bishop wishes the old pattern we will send it to him by express at his cost, to show him how long we have been using it with great success. We have others that we use all the time. Yours truly,

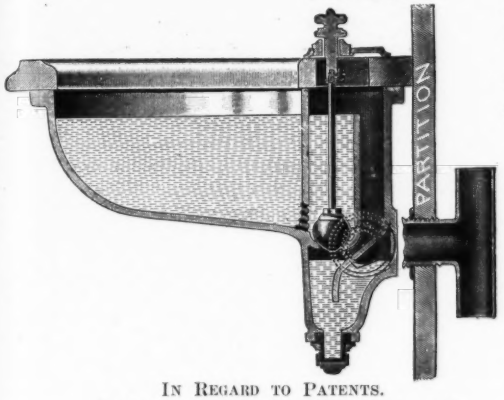
Finegan Brothers.

They Make the Regal Basin.

Chicago, Ill. To the Editor of "Domestic Engineering," Sir: We notice on page 57 of your February issue an in-

quiry as to who manufacture the "Regal" basin. On this basin we control the patents in Chicago. Yours truly,

Peck Bros. Co.



IN REGARD TO PATENTS.

Saratoga Springs, N. Y.—To the Editor of "Domestic Engineering." Sir: Will you kindly advise me through "Domestic Engineering" of the general standing of the following countries as to their general sanitary methods of building: Belgium, Spain, Austria, Russia, Denmark, Brazil, South Australia and Japan?

Do you think it worth while to secure patents in any of these countries on an appliance for water closets that promises to be a success in the United States, Great Britain, France and Germany?

ANSWER.

We would not advise you to take out patents in Belgium, Spain, Austria, Denmark, Brazil or Japan. It might be worth while to take out patents in Russia and Australia. The sanitary standards of Belgium, Austria, Denmark and Japan are as yet too low to warrant an American manufacturer in spending money to protect patents in those countries. Neither Spain, Brazil or Australia are manufacturers to any great extent of these goods and their imports would naturally come from Great Britain, France or Germany.

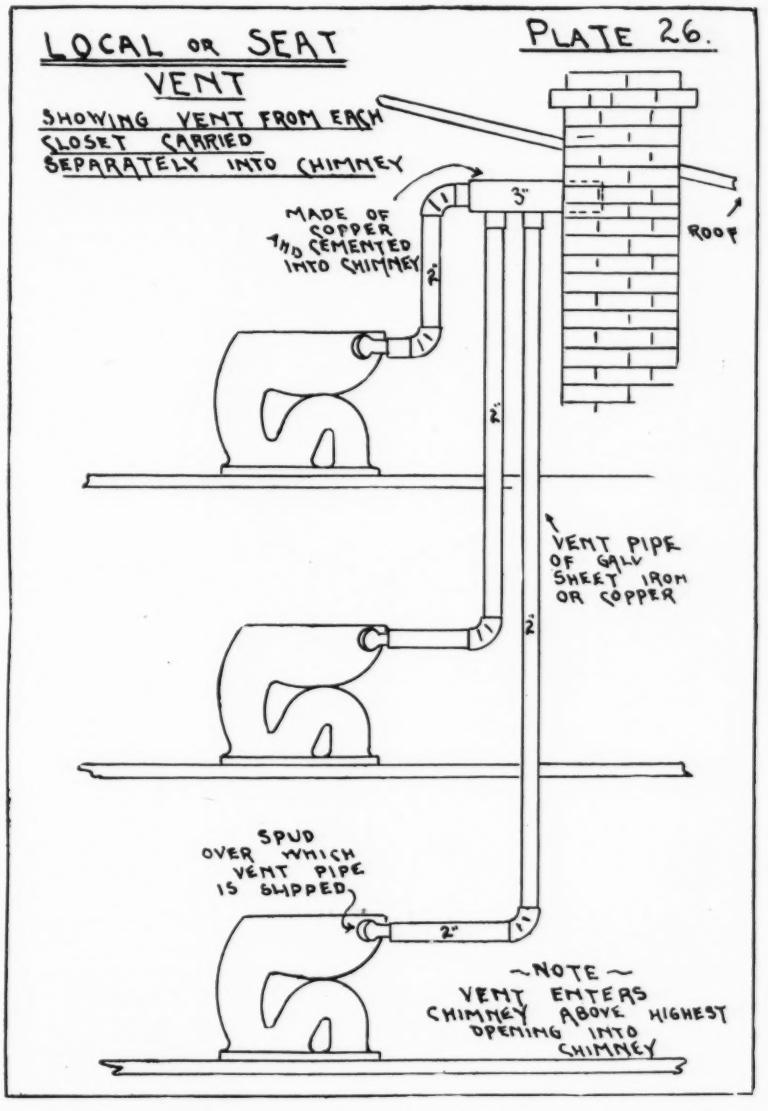
WHO MAKES ALUMINUM SOLDER.

Halifax, N. S.—To the Editor of "Domestic Engineering." Sir: Will you have the kindness to inform us who manufactures aluminum solder?

ANSWER.

There are a number of aluminum solders on the market; the best of which are not entirely satisfactory. The great trouble in aluminum solder lies in the fact that it is very difficult to sweat two pieces of metal together and also that many solders will not stand the test of time. Galvanic action is set up between the solder and the aluminum. About the best solder on the market is handled by Janney & Steinmetz, Drexel Bldg., Philadelphia, Pa. This is the so-called Richards solder invented by Prof. Richards of Lehigh University. You can also get some knowledge of aluminum solder from L. F. Altpeter, No. 758 So. Halsted St., Chicago, Ill. This party has a solder for sale. There is also a solder manufactured by Edward N. Cook, No. 144 Pine St., Providence, R. I. From all of these people you can get directions for soldering.

The Pittsburg Reduction Co., Pittsburg, Pa., quoted on Feb. 23, Richards aluminum solder at $1 per pound.



CAUSES OF POOR CIRCULATION.

Atlanta, Ga.—To the Editor of "Domestic Engineering," Sir: I have put in a steam heating job that does not give satisfaction, and I have failed to find anyone who can tell me where the fault lies. There are two cast iron sectional boilers. The steam and return mains are overhead. It is a two pipe, low pressure, gravity job. The job works all right except ten or fifteen feet on the ends. These ends fill with water and shut the heat off the last radiators, and with the best efforts of five or six expert steam fitters, the water still remains at the ends as long as there is over one pound of steam in the boilers. With one pound, the last radiators will heat a little. By referring to the sketches enclosed, you will see my trouble. I have tried many ways to relieve the ends but have failed.

If you will kindly offer any suggestion or refer me to any person or book that will help me out of my difficulty, it will be highly appreciated.

ANSWER.

Our correspondent's trouble is a very simple one, unfortunately not unusual, and in his case can be relieved with very little trouble. In order to show the fault, we describe briefly the operation of a steam heating job. The boilers, which are set on the cellar or basement floor, furnish steam to the entire system, and, of course, the pressure generated in the boiler is just as great against the water of condensation in the return pipes as it is against the atmosphere in the flow pipes and radiators. In practice

the steam main, whose pipes convey the steam to the several risers through which it flows to the radiators, is connected to the steam space of the boiler, and in this job should have been carried to the very highest point possible under the floor. We suspect from the looks of our correspondent's sketch that he could have carried his steam main considerably higher than he did. The horizontal flow remains, which on his sketch are 4 and 5 inches in diameter, respectively, should have been carried to their greatest height with a pitch of one-half inch in ten feet.

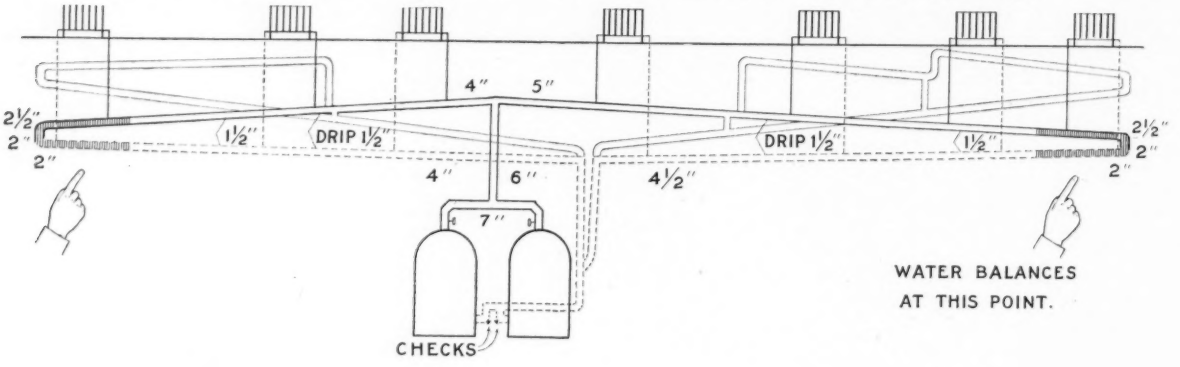


FIG. 1.

When steam is generated in the boiler, it is forced into the steam main and from there into the risers and thence into the radiators. The air which the pipes contain is forced out of the system into the atmosphere through the air valves on each radiator, placed at the end opposite the steam inlet. His steam flows through the main and risers and part of it will be condensed by its heat being transmitted through the pipes to the air and surrounding objects. This condensed steam gravitates to the bottom of the steam main and flows to its lower end and enters the bottom of the boiler from the return pipes. The condensed water is accumulated in the bases of the radiators until a sufficient hydrostatic head is formed to cause it to flow out of them and into the main where it flows downward until it reaches, in this job, the ends of the system where the bends are to bring it back through the return pipes into the boiler.

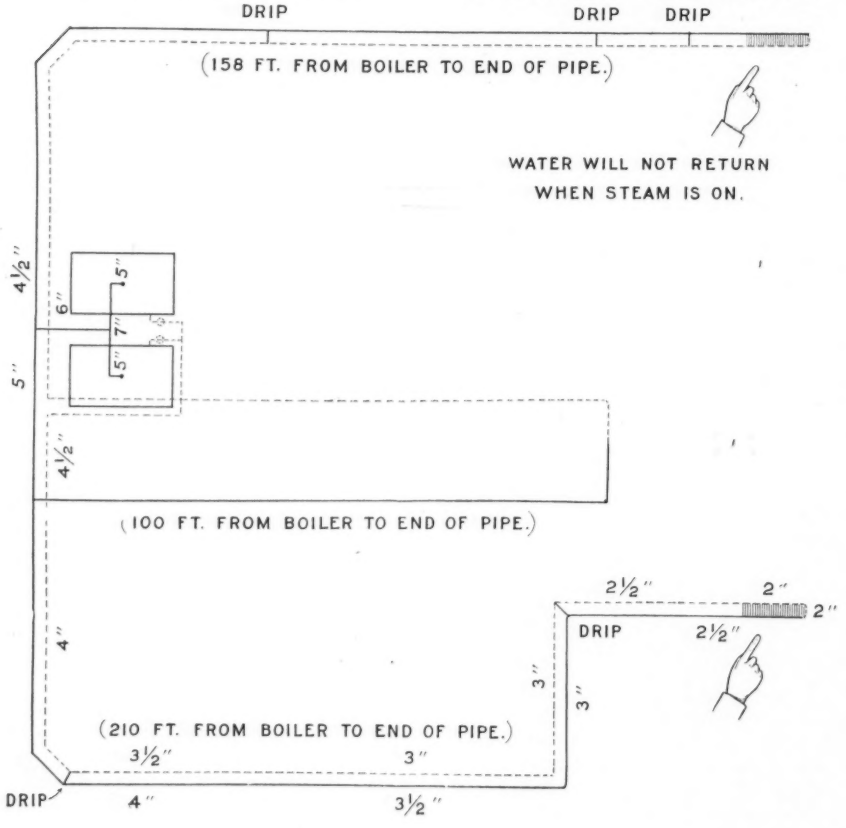


FIG. 2.

Bearing in mind that the pressure in the boilers is operating against the return of the water of condensation, it will be seen that when this pressure is sufficient to hold a column of water equal in its height to the distance between the water line of the boilers and the lower ends of the piping system, the water of condensation will gradually collect in the return pipes until it backs up into the flow pipes as shown by the shaded portions of the piping system of Fig. 1. This will explain why in this job our correspondent refers to the extreme radiators heating with a pressure of one pound, because with a pressure of one pound the column of water held in suspension in the return pipes is not so large but that a slight circulation of steam takes place at the extreme ends of the piping system. When this pressure rises above one pound, the water will back up and cut off the circulation of steam through the extreme radiators. One pound pressure of steam will sustain a column of water 27 inches high. Consequently in a low pressure steam heating job, it is always essential that there be a difference between the extreme ends of the piping system and the water line of the boiler of at least 2⅛ or 3 feet in order to keep the flow pipes free from the water of condensation. This height will give a sufficient hydrostatic pressure of water in the mains to cause it to flow back into the boiler, as it will overcome the pressure so exerted in a low pressure job.

It is simply a question of weight. If the weight of the column of water in the return pipes is greater than the pressure of steam in the pipes, it will flow back, if not, it backs up in the steam mains.

So much for the conditions of the job. Now for the remedy. In the first place, as we said before, if our correspondent could have carried his vertical steam

main to a higher point than he did, that would have been the best way to have done. If other conditions, however, prevent this, which do not shoy on the sketch, the way for him to have constructed the job would have been to insert what are called "relays" in the

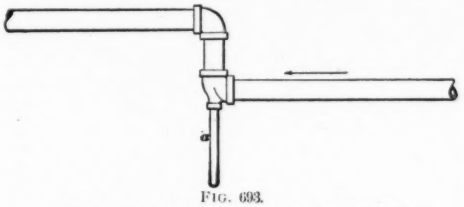


FIG. 693.

steam main. They are constructed as shown in Fig. 3, where the flow pipe is offset and raised as high as possible and carried along to a higher level. The effect of inserting relays into this job would have been to have raised the outer ends of the pipe much higher than they are now. In this particular job, it might have been possible for our correspondent to have used three or more relays in each main, as one of them is 158 feet from the boiler to the end of the pipe. At each of these relays it is necessary to take off a drip pipe shown at a in Fig. 3, which is to be carried into the return pipe. This relieves that section of the pipe of the water of condensation and does not interfere with the steam rising into the higher level of the pipe and continuing on its way. This is often done where a main or horizontal steam supply pipe is to be run a great distance, where on account of head room or other causes it becomes impracticable to carry it uniformly throughout its whole length because the far end will drop too low.

These relays are sometimes called "vertical offsets." If our correspondent will now introduce a series of relays in this system sufficient to bring the distance between the water line of the boilers and the far end of the pipes to 2½ or three feet, we venture to sav his job will work perfectly. In his section of the country, two pipe systems are the rule, where one pipe will answer the purpose just as well. This job should not have been constructed on the two pipe principle. It would have cost very much less and he would have had as good results if constructed on the one pipe plan.

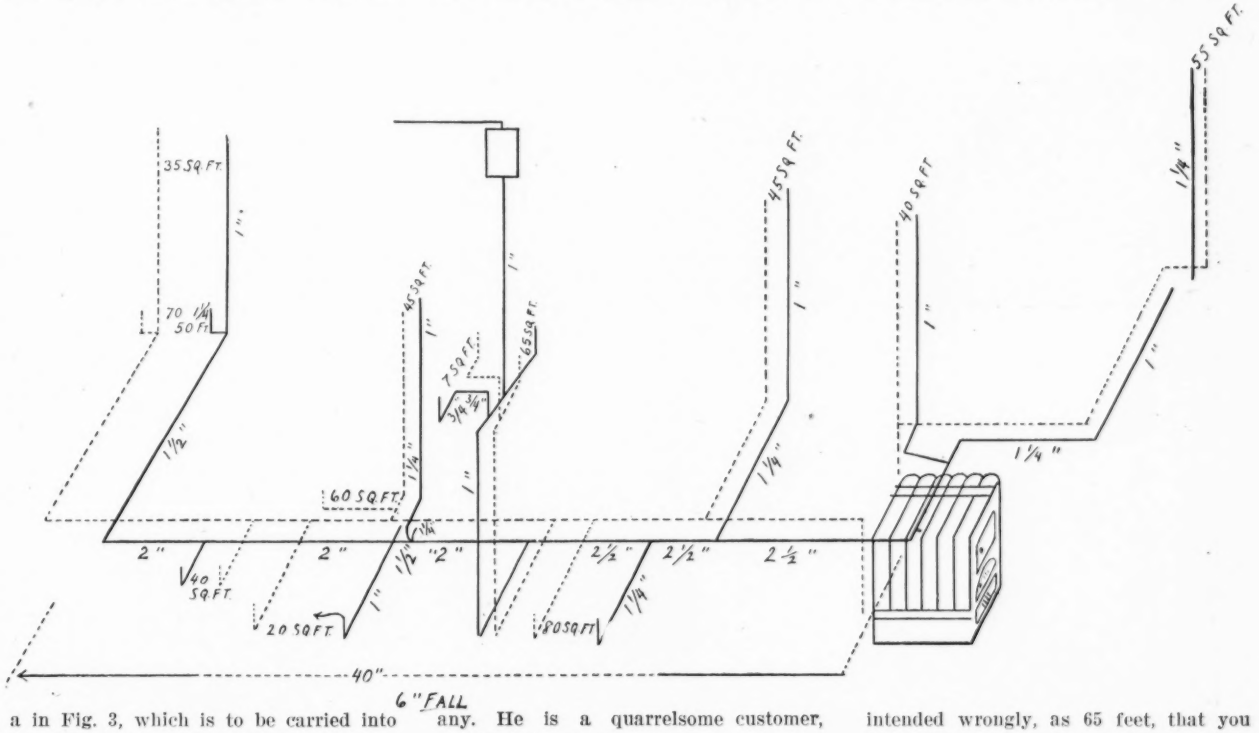
WHAT IS THE TROUBLE WITH THIS SYSTEM?

Norfolk, Va.—To the Editor of "Domestic Engineering," Sir: We enclose you plan of a hot water heating system installed by us. The customer is dissatisfied, and will not pay for it because he says that it is improperly installed. He has read in a book that no radiator should be tapped for ¾ pipe, and in a few cases you will note that this was done. Will you write and point out such changes as ought to be made, it any. He is a quarrelsome customer, and hard to please; a law suit is inevitable, and we would be glad if you would favor us with a careful and thorough as well as prompt reply. We might add that one of his great complaints is that it required an excessive amount of coal. He usually banks his fire at night, and covers over the surface of it with cinders and ashes, and says that it takes three hours the next morning before he can get his house warm. He further states that if he does not bank his fire that it will not keep fire over night. He is using a No. ——, —— boiler.

ANSWER.

The sketch you have sent us of the hot water heating system installed by you is quite complete, but is not entirely so: for example the measurement of the radiator shown at the right of the expansion pipe, is manifestly wrong. You give it 6500 feet. We take it for granted that this should be 65 feet. In the first place, we deprecate a law suit where it is possible to arrive at anything like a just settlement without it. In the second place, any reply that we may give based upon the sketch which you sent us and the meager details which we have in our possession would not be authoritative enough to be of any service as testimony. However, we will answer your letter as thoroughly as possible.

(1) The capacity of the boiler is not given. The catalogue of the manufacturer gives the capacity of boiler as 650 feet, and their catalogue warns their customers that to the measurements of the radiators will be added the measurements of the mains and risers, which are usually 15 per cent. You have shown on your plan, taking the radiator evidently



intended wrongly, as 65 feet, that you have 562 square feet of radiation and to this add 84 square feet of radiation in mains and risers and you have a total of 646 square feet. This boiler ought to carry this amount of radiation, provided you use the right fuel and the system is well installed. Although the manufacturers suggest that it is better to use one size larger than the system apparently requires.

We are unable to tell whether your radiation is properly proportioned to

your exposure. If you have less radiation than you ought to have, the house would naturally heat up very slowly in the morning; whereas if you had an abundance of radiation, it would heat up quickly. It would have been better to have continued your 2½-inch main the same size to the end of the system instead of reducing to 2 inches, because you should favor the radiators at the farther end of the system.

The sketch shows your expansion pipe connected to the flow pipe when it should be connected to the return, or better still, connected independently into the boiler. We will not be surprised to hear from you that the 65-foot radiator and the 7-foot radiator work very sluggishly.

We take it for granted, that your connections to the risers are all taken from the top of the supply plpe. If there is a slow circulation on any radiator, the remedy would be to take out the branches from the top of the main using a nipple and pitched elbow.

If your customer banks his fire with ashes, he will always have a dirty fire all the time. He may be using soft coal with a boiler that is especially adapted for hard coal. If, instead of using ashes to bank the fire with, he would use pea coal, he would get better results. The boiler, however, is so well constructed, that if he will shut the doors and open the check dampers at night, he will not have to bank his fire at all. A ¾-inch connection on a radiator containing not more than 7 square feet, is ample and is often used. Your reducing fittings should be of eccentric fittings.

If there is any further information we can give you which will be of service to you, we shall be glad to hear from you again.

In the sketch which we illustrate herewith the flow pipes are solid lines and the return lines are dotted lines.

The Construction of Cesspools.

Villisca, Ia.—To the Editor of "Domestic Engineering," Sir: I am desirous of constructing a cesspool in a clay soil. In the ordinary construction of cesspools walled up with one layer of brick, the grease, etc., seems to filter through and collect on the clay sides stopping the wasting away of the surplus water. I should be glad to have you show the proper construction of cesspools to obviate this difficulty. Would you advise laterals from pool and how would you make them.

Answer.

The late Col. Waring was an authority on sanitary matters and on the subject of cesspools he had the following to say which answers our subscriber's question so fully that we re-print his remarks with the original diagram taken from "How to Drain a House," published by D. Van Nostrand Co., New York City which "Domestic Engineering" can supply for $1.25:

Those who live in isolated houses, in the country and in the smaller towns, generally solve the whole problem of sewage disposal by the simple formula, "Out of sight, out of mind." The universal remedy is a hole in the ground into which every thing in the shape of liquid wastes is delivered. The only criticism that most people apply to the apparatus relates to the frequency with which is requires to be emptied and to the cost of the operation.

What goes on in the cesspool, and in the ground about it, is entirely unheeded. So long as the overflow is disposed of the devil may care what the hidden processes of disposal are. Unfortunately the devil does care, and much of the worst work that he effects, in his assault on the health of his unwitting subjects, has its starting point in the common cesspool. The worst sewer in the world is rarely so bad as the usual cesspool. In comparison with it a sewer that would be regarded as very foul is purity itself.

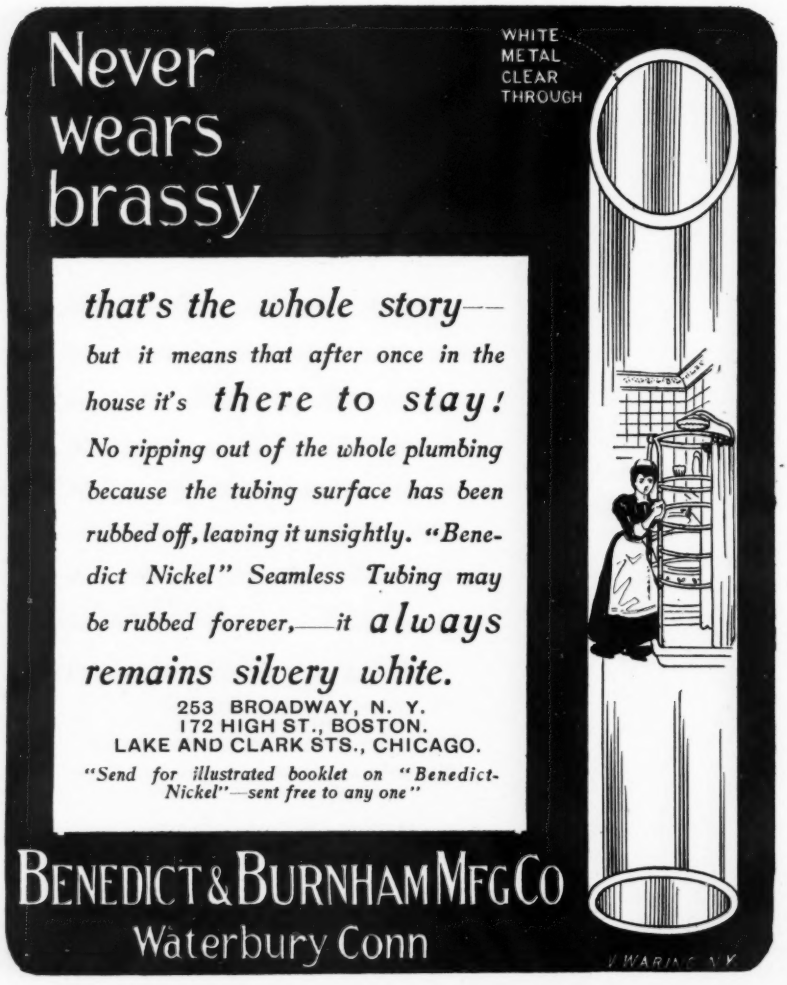
The cesspool works its injury chiefly in three directions:

A. It holds an accumulation of filth of the worst character, in a state of active putrefaction, giving off gases produced by a decomposition that takes place under conditions of the worst sort. These gases cannot be entirely suppressed while a channel remains open for the admission of liquid to the cavern. Unless delivered into the atmosphere, which they inevitably taint, they find their way back more or less directly into the drainage system of the house.

B. In so far as the walls of the cesspools and the surrounding earth are permeable to their passage these gases pollute and poison the ground air, and if near the house, this may find its way from the earth into the cellar.

C. Its liquid leachings and ooze, enriched with the soluble productions of a fatal putrefaction, travel through porous soils, through gravel or sand streaks in heavy ground, and through fissures in rocks to pollute the water of wells and springs even at a considerable distance.

If the fraternity of sanitarians throughout the world are in accord on any one point, it is that the common cesspool, even under the best conditions, is absolutely inadmissible. Surely no householder having the least regard for the health of his own family, or for that of his neighbors, once realizing the inevitable condition, will tolerate its perpetua-


Never wears brassy
that's the whole story—
but it means that after once in the house it's there to stay!
No ripping out of the whole plumbing because the tubing surface has been rubbed off, leaving it unsightly. "Benedict Nickel" Seamless Tubing may be rubbed forever,—it always remains silvery white.
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tion. Fortunately it is no longer necessary that, even in connection with the simplest and poorest house, this dangerous nuisance should exist. The sanitary fraternity are also in full accord as to the general principles of an improved mode of disposal.

What concerns us in this connection, is a proper means for getting rid of the organic refuse and filth contained in the liquid wastes—including those of the water-closet and kitchen sink—of isolated houses which have at least a small area of land connected with them.

The principle on which the best disposal thus far devised is based is this:

The aerated upper layers of the soil are a universal destroyer of whatever organic impurities may be deposited on the surface or intermixed with the earth. Dead organic matter is completely destroyed by natural processes of oxidation and nitrification, wherever, under natural conditions, it is exposed directly or indirectly to the action of the atmosphere in the soil. The agents of destruction in this case are the bacteria of decomposition, those all-pervading micro-organisms, whose increase, growth, and life involve the combination of atmospheric oxygen with the elements of organized matter, a combination always set up under conditions favorable to the growth of these bacteria. Aeration is a necessary condition of the process.

When urine or other foul liquid is thrown on to the surface of the ground it sinks into it and deposits on the surfaces of its particles the organic impurities which it contains. Its water, descending still further, has become essentially purified. As the water sinks away air enters to take its place and every particle of soil that is coated with the waste matters is surrounded with air rich in oxygen. The bacteria, present in all fertile soils, combine the two—much as the respiratory process of higher organisms combines the oxygen inhaled by the lungs with effete matters of venous blood.

This is a slight and popular statement of the results of recent scientific investigation. The process is a continuous one. The destruction of one dose of wastes being accomplished the destroyers are ever eager for more. For their successful and continued operation it is only necessary that the waste matters should be supplied and that air should be furnished alternately. This is the principle on which is based the success of the system of sewage purification by broad irrigation and by intermittent downward filtration. It is as effective in taking care of the waste of a city as of that of a single house, the difference being only a difference of degree.

In the case under consideration, the disposal of the wastes of a single dwelling, generally on land very near the house, may be accomplished in a hidden and inodorous manner. The sanitary result would be complete if they were delivered intermittently over the surface of a lawn. Other considerations sometimes make it important that sewage be kept out of sight and that the distribution of the wastes be beneath the surface.

The Rev. Henry Moule, the inventor of the Earth-Closet, seeking means for disposing of liquid wastes of the house-

EDWARD HARRIGAN, Detroit
President Michigan Master Plumbers Association

hold, for which his closet is not suited, laid agricultural drain tiles along the foot of a grape-vine trellis, leaving their joints open, so that the slops reaching the drain could escape freely into the ground. The influence of this subsoil irrigation on the growth of the vines and of grass was very marked and the disposal was complete and continuous. Later (1868) Mr. Rogers Field adopted a modification of the same device in disposing of the liquid wastes of cottages at Shenfield, Essex, England. He added the important improvement of a flush-tank in which the liquids were retained until it became full, the whole volume being then rapidly discharged into the tiles.

This was a great advance. It secured the uniform distribution of the liquid throughout the whole length of the drains and gave ample time, while the tank was refilling, for the water to settle completely away, allowing air to enter and complete the destruction of the impurities before the next discharge.

The writer, in connection with his residence at Newport, adopted Mr. Moule's device in 1869, as soon as it was made known, and added Mr. Field's improvement soon after the publication of his process. At first, a little difficulty resulted from the delivery of grease and flocculent matter into the tiles, leading to the obstruction of their joints. Early in the experiment it usually became necessary as often as once a year to lift the tiles and wash out their accumulations. This led to the interposition of a settling basin to retain all of these coarser matters. Later the settling basin was placed on the house side of the flush-tank to prevent the disturbance of the deposits in the former by the vigorous discharge of the latter.

The house was provided with earth closets, but everything not deposited in these was delivered to the drains, which were laid under a lawn adjoining the best rooms of the house and a piazza that was much used. The next work of drains began not more than fifteen feet from the edge of the piazza and the furthest of the section was not more than fifty feet away. The system worked most satisfactorily for eleven years, when the construction of a sewer in the adjoining street made it no longer necessary to use it.

During the whole period of the experiment, the condition of the tiles and of the soil immediately adjoining them was frequently examined. If the opening were made immediately after the discharge of the tank, the earth near the drains had a decided odor, but all other times, even close to the open joints from which the discharge had been copious, there was absolutely nothing to suggest impurity. A handful of earth which a few hours before had been saturated with the foul liquid had no other appearance

G. A. KANTLER, Holland, Mich.
Delegate to National Association of Master Plumbers

or odor than that taken at the same depth from a part of the lawn entirely beyond the influence of the system.

This method of disposing of waste liquids has been used by many engineers and on hundreds of places in different

parts of the country. So far as known, wherever the details of the system have been properly regulated, the result has been entirely satisfactory.

In 1876, in connection with the sewerage of Lenox, Mass., there being no other available means of outlet, a large flush-tank was built at the upper corner of a field near the village, and 10,000 feet of absorption drains were laid. This system was used until another outlet was provided in 1892. Whenever it was properly cared for it was completely successful.

At the hotel at Bryn Mawr, Pa., a system even larger than that at Lenox has been in successful use since 1881. Here, the sewage had formerly been delivered into a brook which ran through private property. The change was made to avoid legal proceedings threatened by the adjoining owner. A little difficulty occurred at first from an unequal distribution of the flow and because of the steep grade necessarily given to some of the drains. These defects were remedied and the working of the whole system has since been satisfactory.

At the Woman's Prison at Sherburn, Mass., where about 30,000 gallons of sewage were delivered per day, the conditions were extremely difficult. Only a small area of land at considerable elevation could be reached, and this was of a very unfavorable character. The system here was on the whole successful, though owing, as is believed, to sluggish drainage through the heavy subsoil, the amount of drain tile used, 20,000 feet, at times proved inadequate to the work. Some years ago a public sewer was constructed into which the prison drain now delivers.

There are few individual houses so far separated from each other that their best relief may not come by public sewerage, which have not sufficient ground about them for the successful application of this system.

Although it was not the intention to enter in this volume so far into the practical technicalities of work as to use any considerable number of diagrams in illustration, it is thought that, as the system under discussion, though largely used in a few Eastern neighborhoods, is still little known over the country generally, it will be proper to make an exception here, and to reproduce from a descriptive article, published in the "American Architect" for March, 1892, the diagrams accompanying it.

Figure 12 shows the construction of the double-chamber tank. The settling-chamber A is a small, round cistern with a wide throat—not less than eighteen inches diameter—to facilitate the removal of its scum and deposit. It receives sewage from a pipe turned down through the dome and barely trapped against the return of air—if deeply trapped, grease accumulates and obstructs the drain; with this slight trap, the flow from an ordinary house suffices to keep it free. It overflows through a deeply-trapped pipe into the discharging-chamber D. It is divided by a wall into two chambers, the top of the wall being just at the overflow

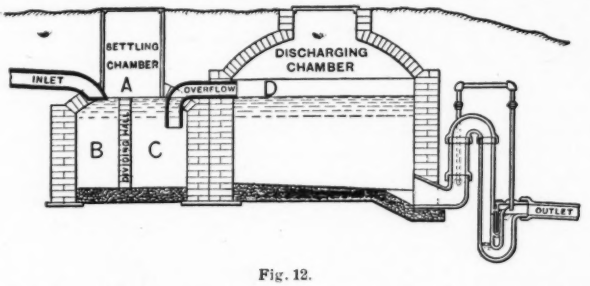


Fig. 12.

line. The compartment B, on the inlet side, has its water considerably agitated by the inflow. Before the dividing-wall was adopted this agitation was communicated to the contents of the whole chamber, and flocculent matters, which would settle to the bottom or float to the top in still water, were carried over by the current into the discharging-chamber. This agitation is now confined to the compartment B, from which the liquid portion flows to the compartment C in a thin sheet over the top of the wall, in such a manner as not to disturb the contents of this second compartment, allowing flocculent solids to settle quietly to its bottom. Under some circumstances, perhaps due to a higher temperature in the sewage, and this to its larger amount, the decomposition of the sediment and of the scum is sufficiently active to prevent accumulation to an injurious amount. In such cases the settling-chamber need never be cleaned. This is not to be depended upon without occasional inspection. In the majority of cases it is necessary every few months to bail out the chamber and get rid of its accumulations, which should be buried or dug into the ground at once.

The liquid overflow from the settling-chamber A to the discharging-chamber D represents practically the full amount of sewage brought down by the drain. The discharging-chamber should be made large enough to hold the product of at least twelve hours; there is no objection to its retaining twenty-four hours' supply a longer retention would lead to too much putrefaction. This chamber is furnished with an automatic siphon; the one shown is what is known as the Rhoads-Williams siphon. Its details are shown in Figure 13.

It depends for its action on the sudden releasing of compressed air contained between the inflow from the tank and the deep trap near the outlet. When the pressure is sufficient to force the water in the blow-off trap a, a, to the bottom of this trap, the air pressure is released, and the head of water, which it had held in the tank, forces a full flow into the spihon and brings it rapidly into action. Air is introduced for the breaking of the siphon after the main flow has ceased by the admission of air from the drain through the pipe b. b. These siphons are sold by flush-tank dealers.

The siphon is located entirely outside of the tank. This obviates the serious fouling of the siphon itself, which has always been a source of difficulty when it was placed within the tank. Its opening into the tank is funnel-shaped so as to take the flow rapidly, and to make sure that there will be no obstruction from such minor solid matters as the sewage may contain. It is not ordinarily found necessary to clean out the discharging-chamber, matters which would otherwise accumulate within it being held back in the settling-chamber.

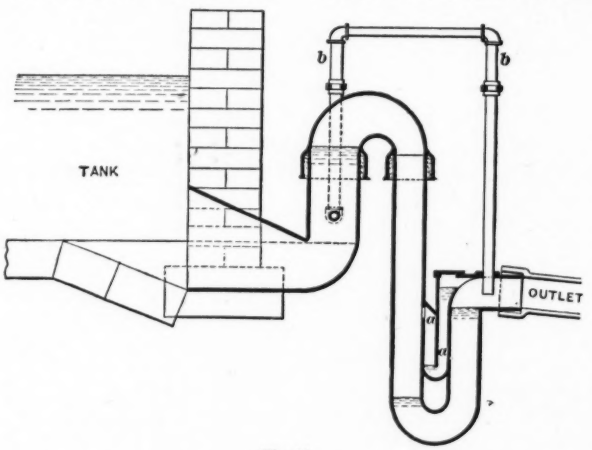


Fig. 13.

The outflow is a slightly putrid sewage

containing more or less fine flocculent matter, not enough to interefere with the proper action of 2-inch absorption-drains. These absorption-drains may be placed at a greater or less distance from the tank as the tank may be at a greater or less distance from the house. They are made of ordinary round 2-inch tile in one-foot lengths, laid in earthenware gutters, their joints being open about one-fourth inch, and being protected against the entrance of earth by the loose-fitting cap laid on the top. The gutters and caps are of larger radius than the outside of the tile, so that practically the whole joint is available for the escape of sewage into the ground. The surface of the gutter on which the tile is laid should be ten inches below the finished surface of the ground. In a reasonably porous surface-loam, it will suffice to have one foot of tile for each gallon of the contents of the discharging-chamber. The tile, caps, and gutters are shown in Figure 28.

If the soil is heavier, the length must be increased. An impervious clay is not well suited, under any circumstances, for this use, but where nothing else is available there should be at least three feet of tile per gallon. The tile may be one continuous line, or a number of shorter lines, connected with the 4-inch main leading from the flush-tank. The tiles need not be more than three feet apart, though twice this distance is not unusual. In fact, the system is in this respect a very flexible one, and can be adapted to land of any shape or inclination. The fall of the main line from the tank to the absorption-drains should not, especially after coming within 20 feet of the first line of tiles, have a fall of more than 4 inches to 100 feet. Its joints should be cemented, and the branches for connection with the tile lines should come out from the bottom of the tile, not from the middle, as is usual with branches of vitrified pipe. Special pieces for this purpose are to be obtained from the dealers. The absorption-lines themselves should have a fall of not more than 2 inches per 100 feet: more than this gives a tendency to an accumulation of sewage at the far end of the line, and if the line is long, to a breaking out of the sewage at the surface.

Figures 14, 15, and 16 show three different methods of applying this system, according to variations of the ground. In each case the dotted lines are contour-lines showing differences of elevation of one foot.

In Figure 14, the flush-tank A receives its sewage from the sink-drain leading from a corner of the house. Its discharge is through a direct line to the point c, starting at the tank at a depth of three or four feet below the surface and coming to within a foot of the surface at the point c. At the point c the main drain is turned at an angle and has three different outlets, to be used, one at a time, in alternation. The first one communicates with two parallel drains at the bottom of the field, these having a sufficient combined length to receive the whole discharge of the tank. The second one runs parallel to the first, to two absorption drains corresponding with the first two. The third communicates with the other system of three parallel lines, which are shorter, having about the same aggregate length as the two of the other systems. They are carried around nearly parallel to the contours to secure the requisite slight fall.

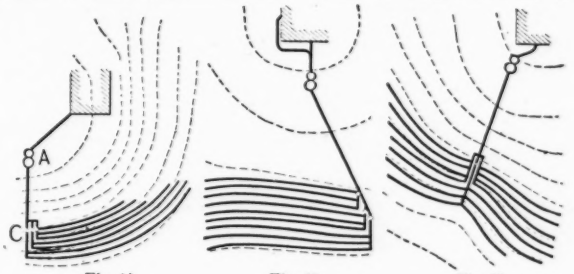


Fig. 14. Fig. 15. Fig. 16.

In Figure 15 the flush-tank is fed by two drains from the house and connects, as shown, with three series of three drains each. The land is much more nearly level, and the nine absorption-drains are in ground having a total fall of only one foot.

In Figure 16 the flush-tank is fed by a single drain, not straight, and connects with its alternating gate. There are two series of drains, four on one side of the field and four on another, while a third line connects with the series of three shorter drains on each side of the medial line.

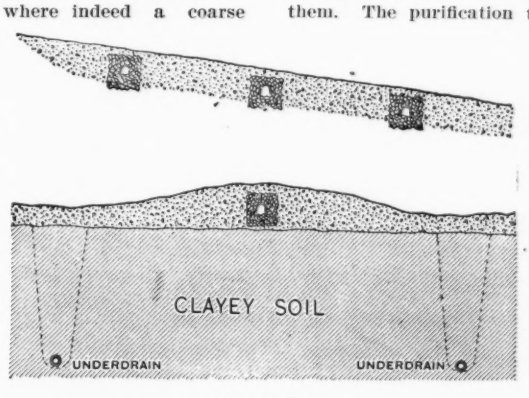
The flush-tank may be placed in any position and at any distance from the house, and the field may be at any distance from the flush-tank to which a proper fall can be obtained.

One modification of this system, which will obviate much of the difficulty by requiring a greatly reduced retention of solid matters, where indeed a coarse screen may, in some cases, be made to hold back all that is necessary to retain, consists in the use of larger absorption-tiles, say 4-inch or 6-inch, with open joints, fully one-half inch wide and laid in coarse gravel or other very open material just under the surface of the ground in two, or better, three series, each of which has sufficient capacity in its pipes to receive the entire contents of the tank at each discharge. The discharge being at intervals of from twelve to twenty-four hours, the liquid sewage with its soluble and its finer suspended impurities will have ample time to leak out into the soil; and during the period of intermission, while the other two series of drains are being used, worms, beetles and other insects will consume, or decomposition will destroy, the relatively small amount of deposited matter, which, however, might be sufficient to obstruct 2-inch tiles.

A still further modification consists in making the drains of similar large tiles of "horseshoe" shape, laid in a trench filled with coarse gravel or broken stone. The capacity of the tiles and of the voids among the stones in each series should be sufficient to receive more than the full contents of the tank.

Cross-sections of 4-inch horseshoe tiles, laid in trenches filled with stone or gravel, are shown in Figures 17, 18, and 19.

In Figure 17 the ground is supposed to be reasonably absorptive, like garden mold. In Figure 18 the natural soil is very heavy and non-absorptive, and is level, or nearly so. It is thoroughly underdrained and is covered with sand or gravel in low ridges, being deeper at the absorption-drains than midway between them. The purification takes place entirely in this porous and well-aerated surface, the clarified water sinking into the drained ground below. In Figure 19 the land is non-absorptive and has a decided slope. It should be well under-drained



Figs. 17 and 18.

with tiles running up and down the slope. The surface is covered with sand or gravel, and is divided into sections by banks of clay (under the sand) at the foot of each section. The sewage is delivered into a horseshoe tile, with broken stone, at the upper side of each section, and is purified (and its water is absorbed)

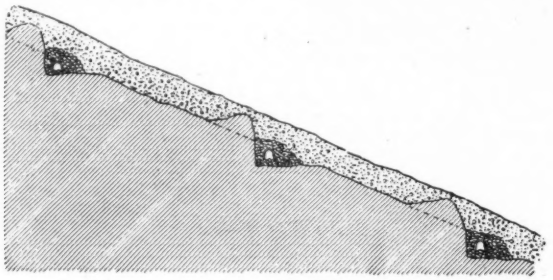


Fig. 19.

before it reaches the clay bank below, or is held by this bank until it is disposed of.

This question is often raised with reference to the sub-surface system: "If the dire results of the use of the ordinary leaching cesspool are so serious, why is it not just as bad to discharge the same materials into the ground by leaching drains?" The difference is radical. In the case of the cesspool, the leaching takes place almost entirely at such a considerable distance from the surface that the exclusion of air makes suitable bacterial action impossible, while the delivery through drains laid immediately under the sod is into aerated ground which is teeming with bacteria.

In the system described above, a certain amount of putrefaction is inevitable, and putrefaction is always objectionable. When once its fæcal matter is submerged, so as to prevent the exhalation of its odors into the atmosphere, *fresh* sewage is entirely inoffensive to the smell. It is simply so much dirty water. It might be thrown in considerable quantities on to a grass plat without other objection than that which would attach to the sight of its solid portions. Unless thrown so frequently and in such quantities on the same spot as to saturate the ground, exclude the air, and so prevent proper bacterial action, it would produce no odor whatever, barring the trifling odor of exposed fæces. The same sewage retained for two or three days in a barrel, vault, or cesspool would enter into a state of offensive decomposition, and would constitute a nuisance of a serious character.

The real problem in the disposal of household sewage, and indeed of the sewage of large institutions, and even of towns, is to bring it into contact with a suitable oxidizing medium while in so fresh a condition as not to be offensive, and to make sure that the drains and other appliances through which it passes shall at no time become offensive. Offensive odor is, of course, chiefly to be guarded against; but offense to the sight would also constitute an important objection. No method has as yet been devised by which the whole process could be appropriately carried on on the front lawn of a dwelling-house. We have, however, arrived at a point where, even in a reasonably secluded back-yard, all of the conditions may be satisfied. Setting aside exceptional cases, where only the sub-surface system with a double-chambered flush-tank would be acceptable, the work may be done in a great majority of instances by a system of surface disposal or of sub-surface disposal with large pipes, with an automatic flush-tank which may at all times be thoroughly aerated and which may be cleansed with sufficient frequency to prevent odor from its sliming. Especially in connection with such a flush-tank can the ventilation of the main drain and soil-pipes be maintained with such completeness as to prevent the accumulation of odors in them. The objection to placing a flush-tank of this character quite near to a house is rather fancied than real.

The nearer it is and the more constantly subjected to inspection, the greater will be the certainty of keeping it always in good condition. On the other hand, the farther from the house, the more will these solid parts of the sewage be broken up in transit, the less imperative will be the need for scrupulous cleanliness, and the less the care required; civilized living, however, requires great care in all such matters. Civilization is only lately beginning to take cognizance of this requirement, and the public at large is still disposed to like best a system which calls no attention to itself, and of which the objectionable features are so hidden as to be easily forgotten. Even under their best development, such systems belong to the "out-of-sight-out-of-mind" class.

Accessibility and exposure to constant inspection, now universal, in the best plumbing practice of the day, are equally desirable in the case of apparatus for the disposal of sewage outside of the house. The cesspool, the vault, and the double-chambered flush-tank will soon have become things of the past, among those who care for good sanitary conditions. Their places will be taken by some device having the essential features of the system described below, combining efficiency with the possibility of, and the demand for, perfect cleanliness. This being accomplished, the "horrid drains" will soon cease to exist, or to be thought about.

It is not to be supposed that this precise manner of applying the system will long remain the accepted one. But the principle of the arrangement seems to embody all the elements of permanence. This principle may be thus stated:

Deliver the sewage as soon as produced, through thoroughly flushed and

No top washers or packing
No small nuts or fine threads
Both seat & washer accessible
Quick and easy to operate

Features of the Apex Faucets obtained by a radical change in the construction of the working parts.

MADE ONLY BY

Homer Brass Works
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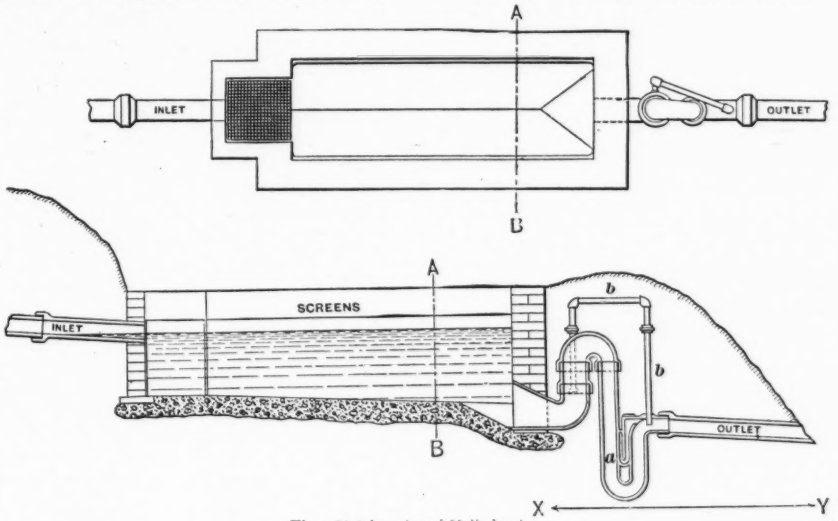
ventilated pipes and drains, to a point outside of the house; hold back its coarser substances by some form of screen which will allow everything to pass that can, in an unobjectionable way,



Figs. 21 (above) and 20 (below).

be disposed of with the sewage; accumulate the regular flow through the drain in a receptacle large enough to hold the supply of a few hours, or of a day, as the case may be; the receptacle becoming full, discharge its contents automatically,

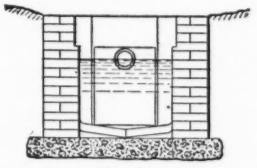


Fig. 22.

rapidly, and completely, on to the surface of the ground, or into drains immediately below the surface, for its final, complete, and inoffensive disposal; arrange the screen and tank in such a way that they may be kept in a cleanly condition with little labor and without requiring the constant superivision and nagging of the master of the house. The appliances shown in the Figures 20 to 27, and the method of working described in connection therewith, seem to constitute a satisfactory application of this principle.

Fig. 23.

Fig. 24.

Figure 20 shows a vertical, longitudinal section, Figure 21 a plan, and Figure 22 a vertical cross-section of a new form of flush-tank, of which the inside measurements are, a width of one foot eight inches, a length of six feet, and a height of two feet. At a distance of four inches below the top on the long sides, a ledge two inches wide is formed by setting the brickwork of the walls that far back.

This ledge is intended to receive wire-tank may be increased to any number of multiples of two feet in order to obtain cloth screens twenty-four inches square, shown in Figure 24. The length of the the desired capacity. A tank eight feet long would take four screens, a tank ten feet long, five screens, etc. The uniform width is maintained, as the screens are made only in the one size, and as they would be liable to sag if much wider between their supports. The bottom of the tank is so graded as to deliver its contents entirely at the center of the

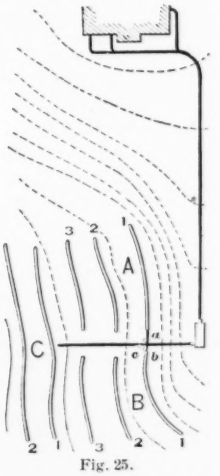


Fig. 25.

discharging end, where there is a depression equal to the receiving height of the throat of the siphon at its narrowest part. At the end of the tank there is built a recess fifteen inches square to receive the screening-cage shown in Figure 23.* This cage is made of galvanized iron wire cloth with 1-inch meshes. It is entirely closed at the top and bottom and on three of its sides. One of its sides, that which is to be placed next to the inflowing drain, has an opening at its top ten inches square. This cage constitutes a complete screen to withhold whatever will not pass a 1-inch mesh,—paper and all solids of considerable size. The agitation of its contents by the inflow will break up much of the softer solid parts of the sewage and carry them through the meshes; what will not so pass must be retained, because it would tend to obstruct pipes in the case of sub-surface delivery, and might make objectionable deposits on the ground in the case of surface delivery. These cages are furnished in duplicate, so that whenever one is removed for cleaning, another can be substituted for it immediately. The one removed, after standing a few minutes, will have parted with all of its liquids, and its solid contents can be shaken out through the 10-inch opening and removed, or dug into the ground. When the cage and the covers, Figures 23 and 24, are all in place, the whole tank is sufficiently screened from observation and is protected against leaves and rubbish which might otherwise get access to its contents. As often as experience shows it to be necessary, perhaps daily, the covering screens, Figure 24, should be removed, after discharging the tank, and its walls and bottom should be thoroughly swept down, the sewage accumulated in its outlet being sufficient for such washing. As above indicated, the frequency with which this cleansing should be performed may vary according to nearness to, or remoteness from, the house, walks, etc.

Figure 29 shows the masonry construction of this tank, the material being

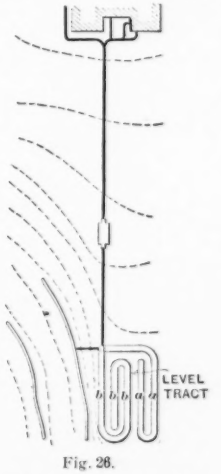


Fig. 26.

brick, glazed on the inner face, and marble or other slabs at the top.

The tank is emptied, after its contents reach a certain height, by the action of a suitable automatic siphon, placed entirely outside of the tank, having a funnel-shaped inlet for the entrance of the sewage. This siphon will require no attention. Whenever the tank fills to the discharging-line, the whole accumulation will flow out rapidly, and when the flow ceases the siphon will "break," allowing no further discharge until the tank has filled again.

The tanks may be built of ordinary brickwork, laid and coated inside and out with Portland cement or with stone or concrete similarly coated. They may be cheaply but simply made, or they may even be lined and capped with white marble. Another excellent material would be white or straw-colored glazed brick laid with close joints. Elegance of finish

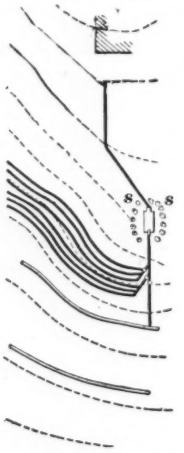


Fig. 27.

will not be altogether useless; for the finer they are the more easily and the more certainly will these tanks be kept in good condition.

In a few cases, all others so far heard from working satisfactorily, it was found that the flocculent matter passing the screen clogged the 4-inch absorption-tiles after a time. This was obviated by constructing a settling-chamber, such as is shown at the left end of Figure 12, in the course of the drain from the house to the flush-tank. This may be necessary in other cases, for surface disposal it has been clearly shown not to be required.

Figure 25 shows the flush-tank, illustrated in Figures 20 to 24, placed at some distance from the house, receiving sewage from three house-drains, and delivering its contents for surface disposal by

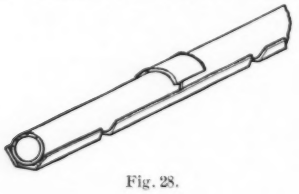


Fig. 28.

the use of three alternating systems of surface gutters or barriers to equalize the flow. These sections are marked A, B, and C, and gates a, b, and c regulating the distribution. In A and B the sewage is delivered along the upper edge of gently sloping land. If the land is steeper, the gutters or barriers must be nearer together to equalize the flow. Water escaping from the upper gutter, or barrier 1, is collected again for a uniform flow at barrier 2, and again at barrier 3. Disposal for section B operates in the same manner. On section C, the gutters or barriers being much longer, only two are needed. These illustrations are not drawn to scale, and are only intended to illustrate the general features of the process.

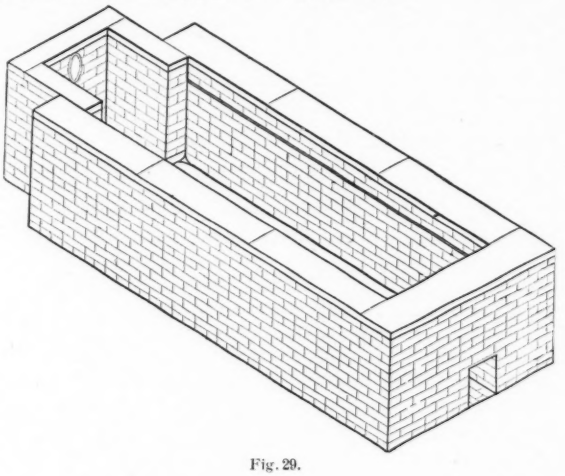


Fig. 29.

The gutters or barriers must be absolutely horizontal, and so arranged that the sewage escaping from them will flow

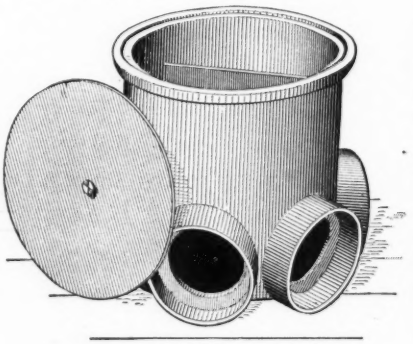


Fig. 30.

evenly over the land below. The distribution may require the cutting of a leader-furrow here and there in the grass with a spade.

This method of surface irrigation removes absolutely all impurity from the sewage; what becomes of it after it has passed over a sufficient area of ground is immaterial. If it escapes into the brook or other water-course, it will by that time have become purer than the water of the brook itself.

In place of the gates a, b, and c, for changing the flow from one tract to another, I am now using a cast-iron distributing chamber, shown in Figure 30. Its operation is indicated by Figures 31, 32, and 33. The pipe A from the flush-tank delivers into this, and from its opposite side run three lines, leading to three sets of absorption tiles, x, y and z. Flat plates, which act as deflectors, are hinged at h, h, fitting closely to the bottom of the chamber. When these plates are set, as shown in Figure 31, the flow is delivered to line y. When turned to the position indicated in Figure 32, the sewage is discharged into z. When placed as shown in Figure 33, the outlet x receives the flow. These distributing chambers are made by the Dececo Co., 146 High street, Boston, Mass.

Figure 26 shows a system in which the same tank is used, receiving the flow from four house-drains, and delivering its sew-

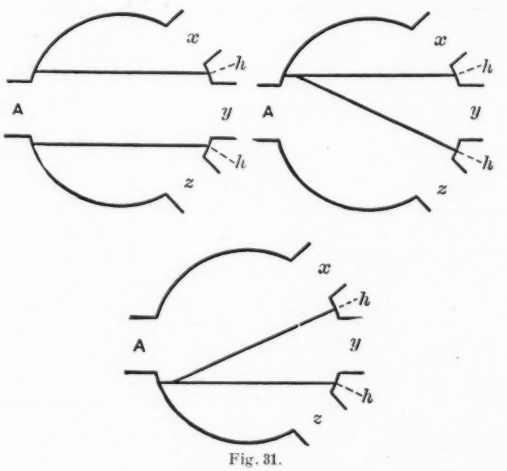


Fig. 31.

age into absolutely level, wide trenches, of sufficient length. In the case shown, there are two of these trenches returned on themselves to give sufficient length.

They are marked a, a, a, and b, b, b. In connection with the same system, there is shown a system of surface irrigation on sloping land. The satisfactory use of the trenches, a, a, a, and b, b, b, requires land of very absorptive character, the more porous the better. The best of all is a very fine gravel. As the trenches become filled on the discharge of the flush-tank, the liquid soaking away into the ground, there is left a felt-like coating on the surface, which requires either a sufficient intermission of use to be destroyed by exposure to the air, or, what accomplishes the same purpose, a thorough raking of the surface from time to time into the material in which the trenches are cut.

Figure 27 shows the same flush-tank surrounded by a screen of evergreens, s, s; two systems of sub-surface absorption-drains, similar to those shown in Figures 14, 15, and 16; and one system of surface disposal similar to those shown in Figure 25.

The variation of details, such as the size and location of the flush-tank, the arrangement, location, and extent of the surface gutters, or barriers, the horizontal trenches, the sub-surface absorption-drains, etc., may be almost infinite, so that the character of the soil, the formation of the surface, the use to which the land is to be put, the necessity for concealment, etc., may be accommodated in all cases. The flow from the flush-tank to the absorption-field is conveniently directed to the different sections by a simple gate-chamber made for the purpose.

While cutters cut into the ground will be effective in collecting and equalizing the flow, they have the drawback that they retain sewage after the flow ceases, and become odorous. The porous barriers (of broken stone, gravel, etc.) allow the whole flow to pass with only such delay as is needed to equalize the distribution. It is best to lay these barriers on a narrow strip of brick paving.

It may with advantage be repeated here that while this system of disposal seems to be as nearly perfect as is possible in the present state of the art, no such system will withstand neglect. It affords a perfect solution of one of the most difficult and dangerous problems connected with life in districts where sewers are not available, and the completeness of the result to be secured amply compensates for the slight amount of regular attention required.

Plumbing Bill Killed.

Topeka, Kan.—(From a Staff Correspondent.)—The bill to create a state board of examiners and regulate the business of plumbing was defeated in the senate Wednesday. It lacked one vote of a constitutional majority. The bill was a sanitary measure, and wos urged by the senators from the gas district.

FAITHFULNESS TO IDEALS.

IF "Domestic Engineering's" scribe rightly understands the purposes underlying the Master Plumbers' Association they are certainly comprehensive enough and public spirited enough to enlist the sympathies and secure the hearty support of every master plumber in the trade. The betterment of the individual by means of the exchange of ideas and personal experiences, the bettering of trade conditions by co-operative effort, the education of the public in matters pertaining to sanitation and the agitation of laws for the prevention of unsanitary plumbing—these are a few of the lofty ideals cherished by the founders of the organization and still held by those who have its best interests at heart. At a convention of the association, then, one naturally expects to find the greatest stress laid upon those things which will do most to elevate the dignity of the craft and assure it of the place in public esteem to which it is entitled by reason of the important service it renders to the public weal. If your representative might be permitted to deliver himself of a few words of kindly criticism, they would take the form of an appeal for greater faithfulness to the ideals of the association. In the course of the past two months he has attended a number of conventions of the state bodies, and while meditating in the outer darkness during the progress of the executive sessions has had it forced upon him that the machinery of the organization must be frightfully ponderous to require so much oiling. Fully three-fourths of the time allotted for the sittings of the convention is taken up with the transaction of routine business and the discussion of the policy of the association, to the exclusion of all other matters. Now, while not wishing to intrude upon the private affairs of the associations, your scribe believes that the same amount of business could be transacted and the social features and technical discussions not neglected, if each of these parts of convention work were given its true proportion.

Your scribe once belonged to a social club, among the members of which was numbered a fellow who had a peculiar genius for bringing business before the meetings. All sorts of motions were introduced for our consideration, and the more we argued against them the more time he took up in advocating them.

CORNER CLOSET

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Ann Arbor Michigan

Finally a number of us undertook to cure the "Lawgiver" of his bad habit, and as soon as he made a motion would call for the question and vote it down. One night he tumbled to the trick, and like the good fellow that he really was, agreed not to trespass on our play time any more. After that our business meetings were models of brevity.

The business matters that are to come up for discussion at a convention are as a rule known to the local associations long in advance, and should be the subject of discussion, so that the delegates may go to the convention with a pretty accurate idea of the will of their constituents. Then, when the questions come up for discussion they will be voted upon expeditiously and without prolonged controversy.

The standing committees should be composed of the pick of the association, so that when a committee is appointed by the chair there will be a reasonable certainty that it will give a carefully considered report. Take, for instance, the essay committee. What an inspiration it would be to hear a thoughtful paper from each member of the committee on some trade topic, instead of the usual excuse: "To busy to prepare anything." So of the sanitary and legislative committees. How proud the convention would be to hear that something had really been accomplished by its agents. That vexatious problem, the apprentice. What a relief to get a little light on that subject. Our old enemy, the public press. How can we get it to quit misrepresenting us and to take us seriously as plain business men, who have greater responsibilities than most other business men and are not unmindful of them.

By taking time for these and other discussions and by enlarging the social features of the convention, more time would be made, paradoxical as it may seem, for the transaction of routine business. The reason for this lies in the fact that with a keener appreciation of the underlying principles of community of interests there would be less time taken up in talking at cross purposes. When each delegate learns that the other fellow really has the interest of the association at heart, they will get together on all important matters in surprisingly short order. Try to work this idea out at your next convention and see if it isn't so.

Decision on Electrolysis Case in Indianapolis.

Judge Carter, of the superior court, Indianapolis, Indiana, overruled the demurrer in the suit of the Manufacturers' Gas Company against the Indianapolis Street Railway Company for $50,000 for damages alleged to have been done to the gas company's pipes by electrolysis. In ruling upon the demurrer, Judge Carter says:

"Where a corporation is exercising a public franchise and does so in such a manner as to cause actual material injury to legal rights and destruction of property when at reasonable expense, by the adoption of well-known and approved appliances, the injury could be avoided, and the person injured is powerless to prevent or guard against such injury, then I think it must be held to be negligence in the use of its franchise on the part of such corporation not to adopt such approved appliances."

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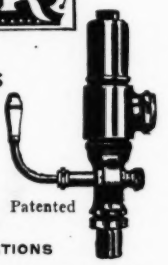

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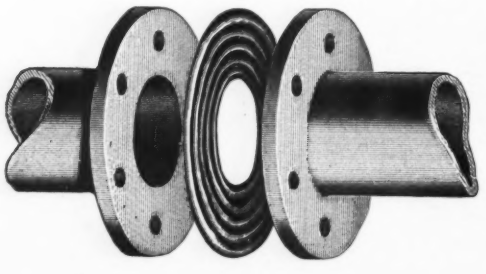

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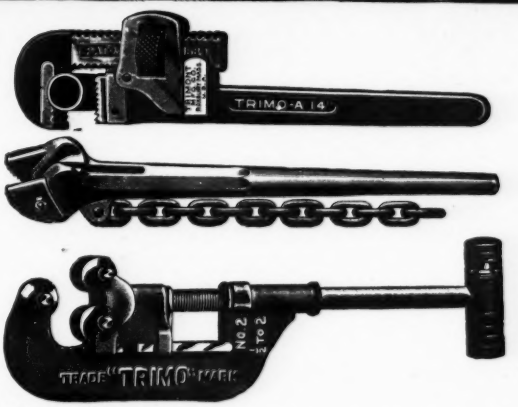

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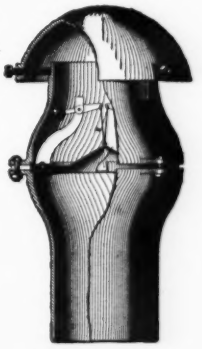

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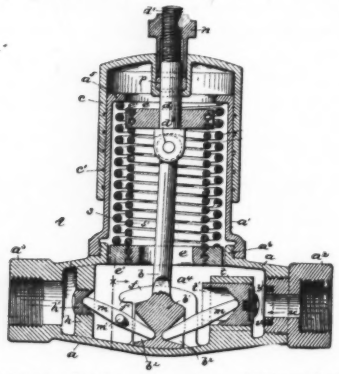
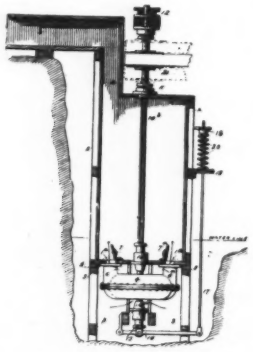
667,046—Pressure reducing valve, John W. Weeks, Providence, R. I.

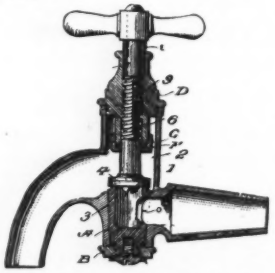


667,091—Drainage pump, Edmund M. Ivens, New Orleans, La.



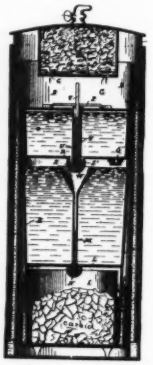
E. A. Creevey, Bridgeport, Conn., is setting one of Cooper's Nautilus closets in a residence in that city.—Adv.

667,109—Faucet, Edwin L. Walter, Scranton, Pa.



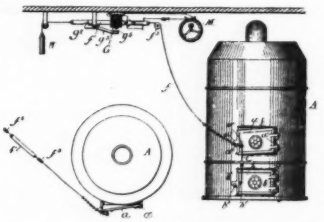
M. J. O'Neill, of St. Paul, has some work on hand in which Cooper's goods will be used.—Adv.

667,161—Acetylene gas generator, William J. Baulieu, Bridgeport, Conn., assignor of one-half to John D. Carpenter, same place.



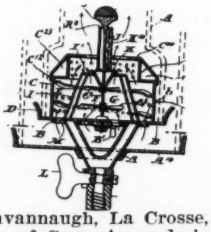
Lindsay & Dodds, Amsterdam, N. Y., are setting a Nautilus closet in some of their work.—Adv.

666,814—Regulating device for furnaces, Charles H. Mayers, Washington, D. C.



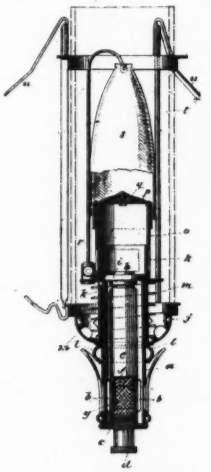
Thill & Lapitz, La Crosse, Wis., are using some of Cooper's fixtures in a job in that city.—Adv.

666,894—Appliance for producing perfect combustion of gas, Frederick M. Bennett and Jonathan O. Fowler, Jr., New York, N. Y., assignor to the Solar (No Mantle) Incandescent Light Company, of West Virginia.

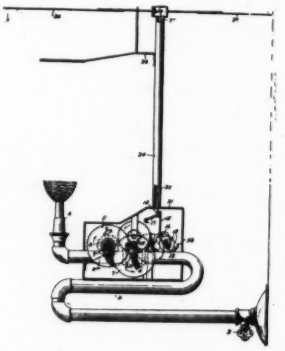


P. F. Cavannaugh, La Crosse, Wis., is using some of Cooper's goods in a handsome residence in that city.—Adv.

666,923—Incandescent gas lamp, Chas. W. Dickel, New York, N. Y., assignor to the Diamond Light Company, same place.

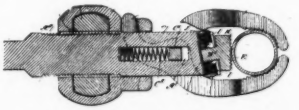


667,186—Automatic gas cut-off. Victor E. Campbell, Winnemucca, Nev.



Samuel Dickson, of Detroit, is setting three of Cooper's closets in some work in that city.—Adv.

667,572—Pipe wrench. Christoffer Peterson, Los Banos, Cal.



A. G. Sippel, Dunkirk, N. Y., has a job in which he is using one of Cooper's Nautilus closets.—Adv.

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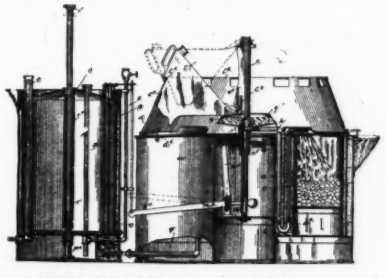
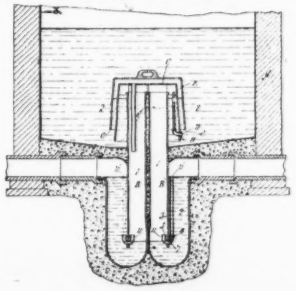
D. H. DECKER, late Ass't Ex'r, U. S. Pat. Office.

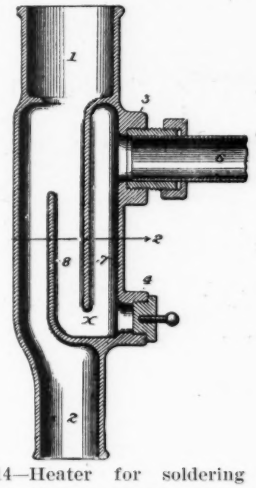
667,178—Acetylene gas generator. Chas. S. Bartholf, Chicago, Ill.



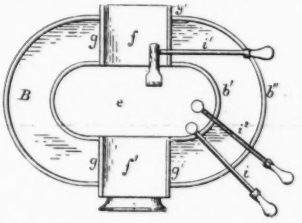
667,352—Flushing apparatus. Frank Walker, Los Angeles, Cal.



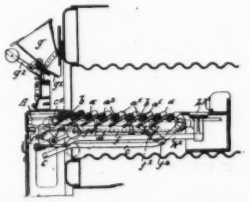
667,303—Trap. George R. Evans, Fresno, Cal.



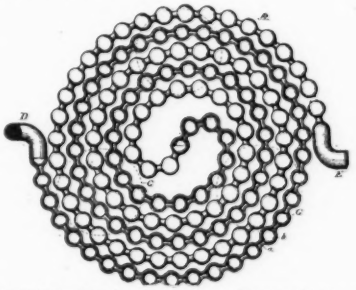
667,214—Heater for soldering irons. John W. Gheen, Astoria, Oreg.



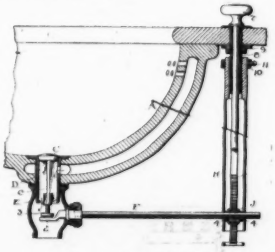
667,399—Furnace grate. Fritz F. Maier, Vienna, Austria-Hungary, assignor of one-half to Sigmund Kanitz, same place.



667,431—Steam boiler. William Esty, Laconia, N. H.



667,443—Basin waste. Bernard Jansen, Cleveland, O.



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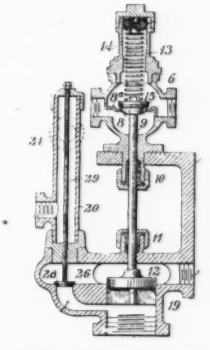
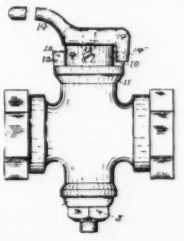
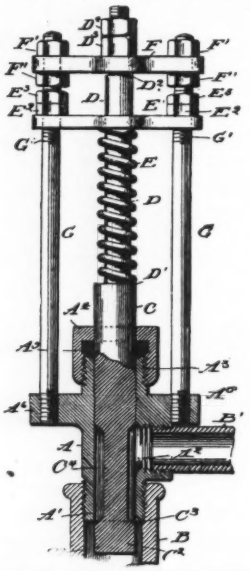
667,356—Water heater. Gustav A. F. Ahlberg, Pittsburg, Pa.



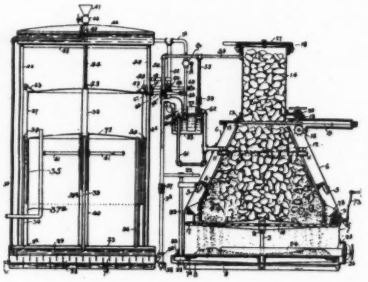
667,627—Stop and waste cock. Frank E. Johnson, Greensburg, Pa., assignor to John T. Kelly, New York, N. Y., and George M. Jones, Pittsburg, Pa.



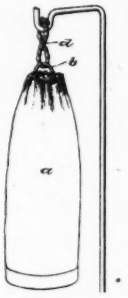
667,429—Automatic regulating valve. Henry Drach, Anderson, Ind., assignor of one-half to J. W. Bailey, same place.



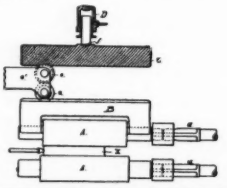
667,542—Acetylene gas generator. Jas. E. Lytle, Cleveland, Ohio, assignor to the National Acetylene Gas Company, same place.



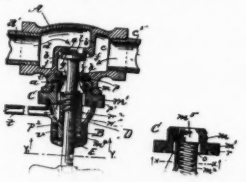
667,622—Suspending attachment for mantles. Warren D. Hann, Philadelphia, Pa., assignor to Edmund S. Hann, same place.



667,686—Apparatus for manufacturing Seamless Tubing. Samuel E. Diescher, Pittsburg, Pa.



667,737—Stop and Waste Cock. William H. Rawe, Pawtucket, R. I.



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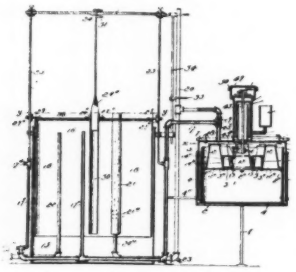
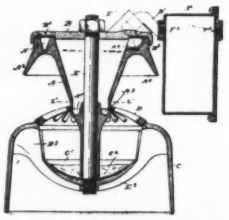
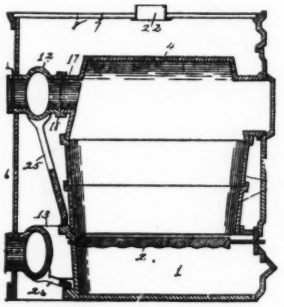
667,451—Acetylene gas generator. Donald H. McPherson, Le Roy, N. Y.



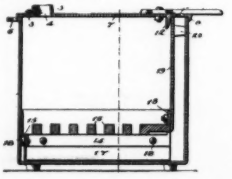
667,641—Hydrocarbon burner. James D. Williamson, San Francisco, Cal.



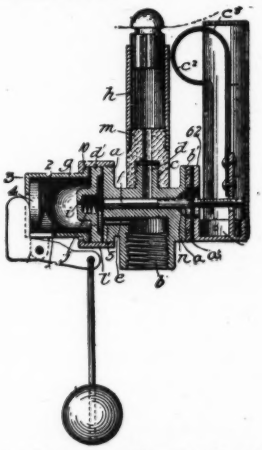
667,671—Hot-air furnace. Jas. T. Brien and Theodore R. Brien, Hoosick Falls, N. Y.



667,711—Tank heater. John R. Kirkpatrick, Kendallville, Ind.

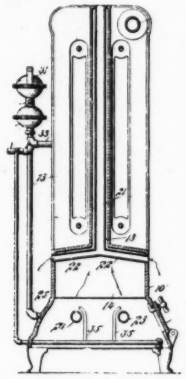


667,702—Gas burner. Howard Hinckley, Washington, D. C.

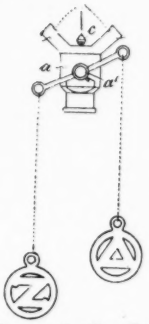


667,743—Wrench. Thomas E. Smythe, Galion, O.

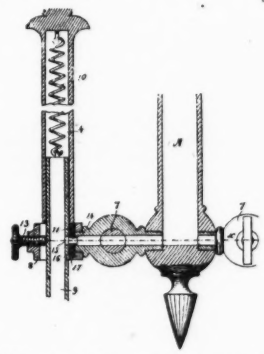
667,606—Radiator. John F. Thompson, New York, N. Y., assignor to G. A. Pratt & Co., same place.



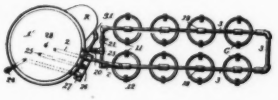
667,608—Acetylene burner with two or several flame rays. Kuno Thurnauer, Nuremberg, Germany.



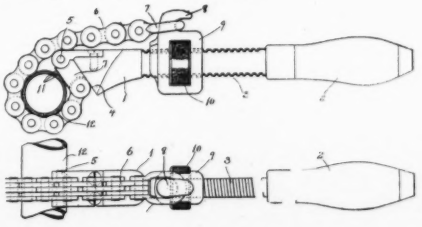
667,756—Gas cut-off. Robert Wynell, San Francisco, Cal.



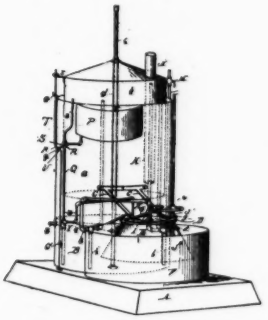
667,801—Acetylene gas generator. Coleman K. Sober and Frederick E. Porter, Lewisburg, Pa.



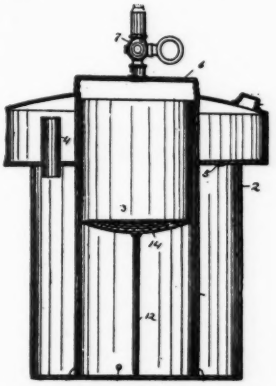
667,852—Pipe wrench. Fred E. Sands, Cambridge, Mass., assignor to William Quinby, trustee, same place.



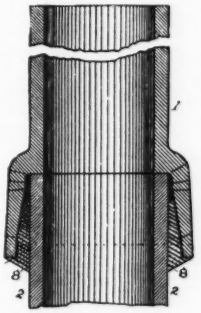
667,766—Acetylene gas generator. John C. Charbeneau and Joseph Schaldenbrand, Mount Clemens, Mich.



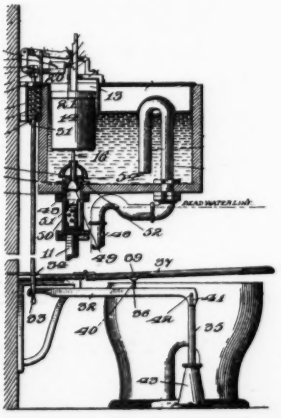
667,774 — Acetylene lamp. John J. Hendler, Fort Wayne, Ind., assignor of one-half to Edward King Reeves, Kansas City, Mo.



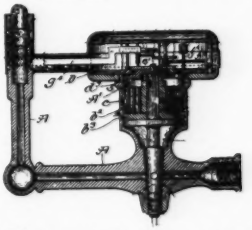
668,298. Self-Centering Sewer-Pipe. George W. Raymond, New York, N. Y.



667,878—Flushing apparatus. William P. Hastings, New York, N. Y.

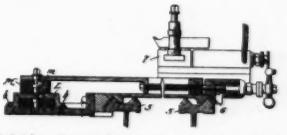


667,656—Automatic gas cut-off. Joseph C. Heald, Newfield, Me., assignor of five-sixths to Patrick H. Connor and Edward J. Bahan, Amesbury, and Alfred C. Fowler, Haverhill, Mass.

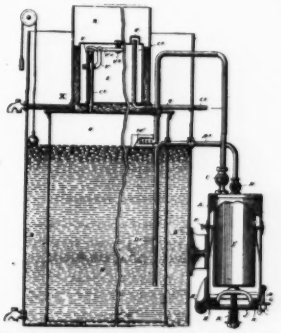


667,857—Pipe-cutting tool. Alexis E. A. Wathier, Homecourt, France.

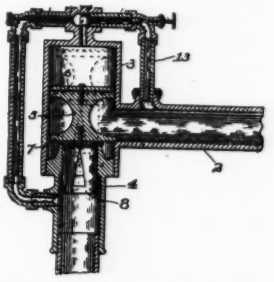
667,912—Taper attachment for metal-working lathes. John D. Hazlet, Cincinnati, Ohio.



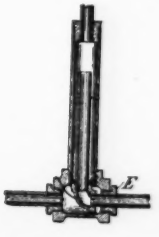
667,919—Acetylene gas generating apparatus. Donald McDonald, Yarraville, Victoria.



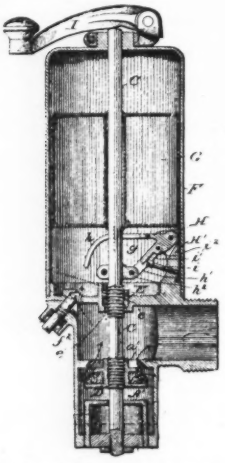
668,202. Automatically-Closing Valve. Joseph W. Nethery, Indianapolis, Ind.



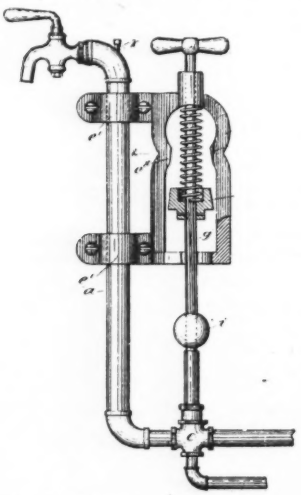
668,236. Oil-Burner for Furnaces. George C. Thom, Johnstown, Pa., assignor to the Lorain Steel Company, of Pennsylvania.



667,951—Flushing valve. Wilber J. Pine, Oshkosh, Wis., assignor of one-half to L. Frank Gates, same place.

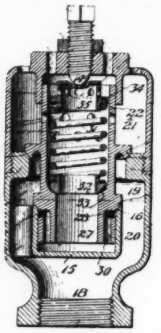


667,952—Combination key and automatic stop-cock. Charles T. Randall and Edward G. Holden, Dallas, Tex.

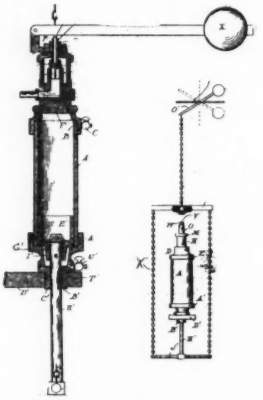


668,308. Scoop for Cleaning Cess-Pits, Etc. Thomas Finch and Charles E. Finch, Paeroa-Auckland, New Zealand.

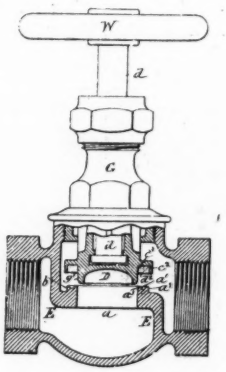
666,109. Safety Valve. John E. Osmer, Clinton, Iowa.



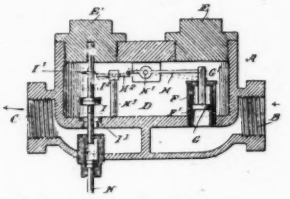
668,156. Damper-Regulator. John R. Bishoff, Claireview, Mich.



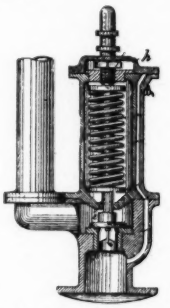
668,012—Globe or other valve. Nathaniel C. Locke, Salem, Mass.



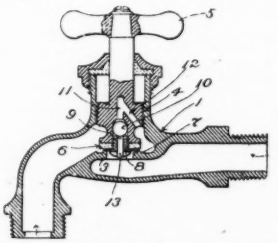
667,963—Automatic cut-off valve. Ralph E. Vail, Mount Vernon, Ohio.



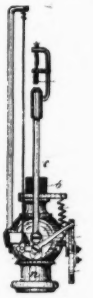
668,065—Protecting device for spring-pressed valves. Hermann Stein, Hamburg, Germany.

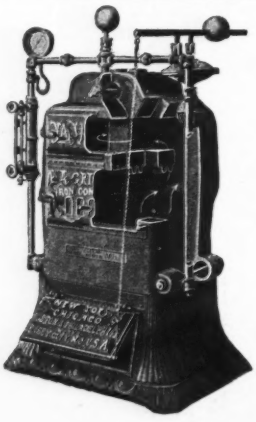


668,355. Faucet. Isaac Osgood, Amesbury, Mass.



668,249. Self-Lighting Gas-Burner. Friedrich Zacher, Hamburg, Germany.





THIS TIME WE SHOW YOU OUR

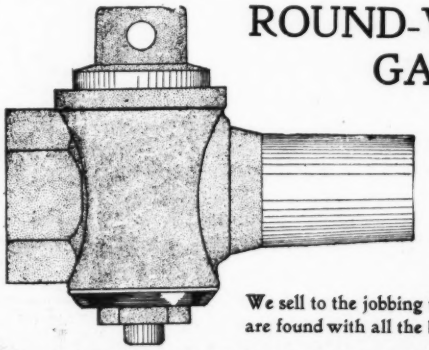
Bundy La Villa Boiler made for Steam or water

as are also our Bundy Tubular, La Flora, Jewell and Daisy Boilers. We also make the

BUNDY RADIATORS AND STEAM SPECIALTIES.

A. A. GRIFFING IRON CO.

New York. 66 and 68 Centre Street
Boston Philadelphia Jersey City
Send for cataloge D E



ROUND-WAY GAS COCKS

A Specialty with us. Permit passing a rod through the cock to remove obstuctions from the pipe.

We sell to the jobbing trade only; our goods are found with all the best jobbers.

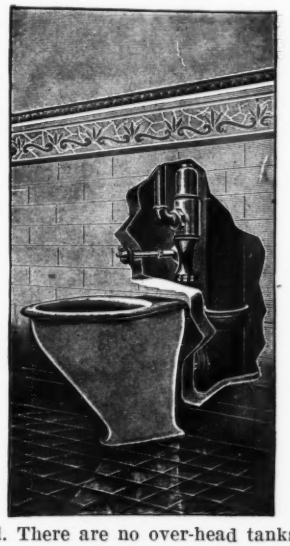
POWHATAN BRASS & IRON WORKS
CHARLESTOWN, W. VA.

Why Not Be the First?

The "Kosiol" waste is a new device invented by a plumber for plumbers, who can put them in plumbing systems already installed and greatly improve the sanitary features of the plumbing. Why not be the first to introduce it in your town or city? $2.50 sent to L. Kosoil, 524 Second street, Louisville, Ky., will bring you a sample.

A Jail Closet.

This illustration shows a closet which is designed especially for jails. There are no exposed parts which can be tampered with, broken or put out of order. It is simple, durable and easily adjusted. There are no over-head tanks required. For alms houses, jails and public places this will prove to be a very desirable article. Upon application to the National Supply Co., Toledo, O., catalogue will be sent if you mention "Domestic Engineering."

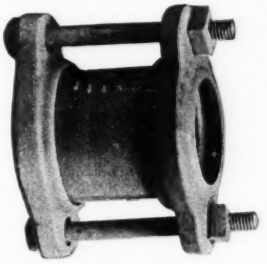


A Superb Catalogue.

"Domestic Engineering's" Greater New York edition desires to acknowledge receipt of a copy of the elegant new catalogue of the Schneider & Trenkamp Co., of Cleveland. The cover, richly illuminated in gold and colors, shows the figure of a plumed knight in armor, bearing aloft a standard, upon which is inscribed the word "Reliable," the name borne by this firm's immense line of gas stoves, ranges, water heaters and cooking utensils, a description of which fills the one hundred and twelve pages that follow.

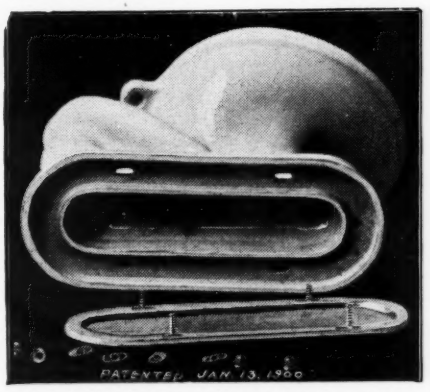
The Abbott Fittings.

This illustration shows the Abbott clamp, manufactured by the Victor Supply Co., of Springfield, O., which is used for natural and artificial gas, water and steam lines. No threads are required in fitting up pipes when these clamps are used. A catalogue has been issued which shows all the forms in which these clamps are made which will be sent upon application to the manufacturers if you mention "Domestic Engineering."



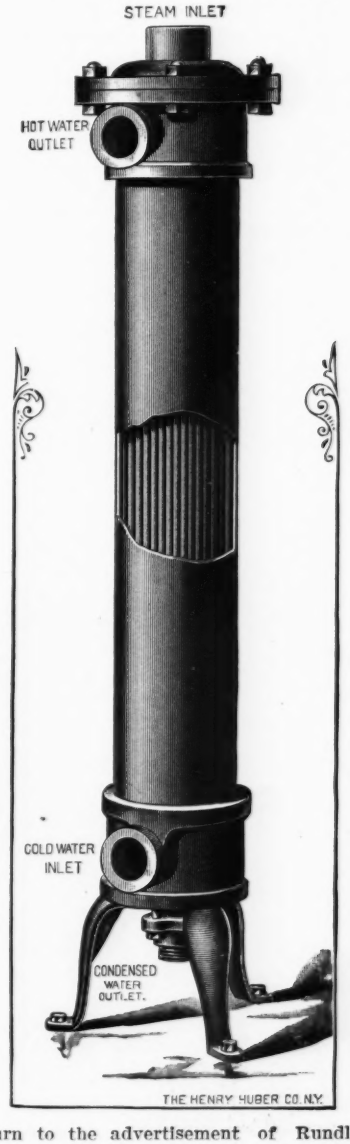
"The Sure Fit."

Well, here is a new thing! You may not need it today, but when making a floor connection which is sure to be tight you have to have it. It is very annoying when you get a closet set to have the first flush show a leaking connection at the floor. This "Sure Fit" is made by the Trenton Potteries Co., Trenton, N. J., and your jobber will give you the price of it.



The Gegenstrom Hot Water Apparatus.

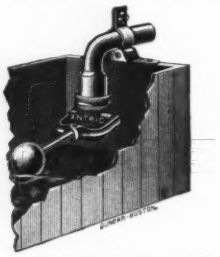
On another page of this paper we illustrate the application of the "Gegenstrom" hot water apparatus for producing instantaneously warm or hot water by means of steam. The application shown there is of a rain bath for use in public institutions, hospitals, armories and people's bathing establishments. The illustration we show here is an enlarged cut of the device itself, and to see how it is connected up in use, you should turn to the advertisement of Rundle-Spence Mfg. Co., Milwaukee, Wis., who are the western agents for this device.



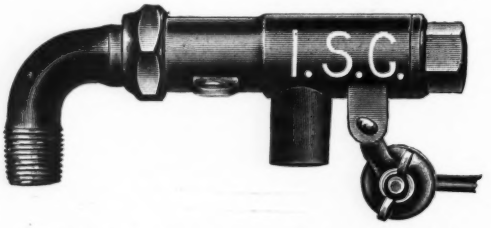
H. F. Hogan, Sioux City, Iowa, is setting some nice fixtures in a job he has on hand. The goods were furnished him by Wm. S. Cooper Brass Works, of Philadelphia.—Adv.

THE XNTRIC BALL-COCK.

This illustration is of the Xntric ball-cock for high or low pressure. Plumbers will particularly notice the size of the ball, which is only 3½ inches, but it does the business. It is guaranteed for two years and will not hammer and is said to be the only valve on the market where the valve is closed by water pressure.



It can be used with hot or cold water. It has been used with great success in the Massachusetts State House and the U. S. Post Office building in Boston. A postal card addressed to the Xntric Valve Co., 36 Boston avenue, Boston, Mass., mentioning "Domestic Engineering," will call forth a more extended description of this device.



THE "I. S. C." BALL-COCK.

Here is a ball-cock which is reasonable in price, made of the best material, works well under high and low pressure, is noiseless, keeps in order and is easily repaired. It seats on leather saturated with linseed oil, and will not hammer even under the pulsation of a pump. Upon application to Julian d'Este Co., 24 Canal street, Boston, Mass., a catalogue describing this ball-cock and a number of other high grade specialties will be sent.

ASBESTOS PIPE COVERINGS.

Manhattan—H. W. Johns Manufacturing Company have placed on the market a new Asbestocel Pipe Covering which is made in three-foot sections for pipes, and sheets for boilers and other pipe and boiler coverings. There are no improved forms of non-conducting coverings now in use which do not contain asbestos or depend upon it for their efficiency. For purity of material, elasticity and adaptability of structure, combined with general completeness of texture, efficiency and durability, asbestos coverings are standard in quality. Asbestos, when treated mechanically yields a soft, white, delicate and exceedingly strong substance which can be spun, woven and otherwise manufactured into many useful articles. In addition to its fireproof qualities, it is acid-proof and practically indestructible. Asbestos also forms a valuable insulator for electrical purposes.

H. W. Johns Co.'s new Asbestos Catalogue illustrates some of their most important asbestos manufactures. This and samples of their manufactures can be had on application at their New York office.

ACCESSIBLE SEWER FLUSHING FITTINGS.

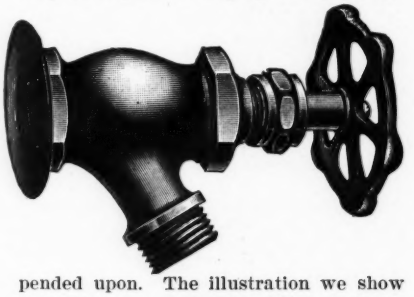
The illustration shows the flushing clean-out trap as manufactured by the Iron Sanitary Mfg. Co., 50-52 Dearborn street, Chicago, Ill. It will resist sewer or back water pressure. It permits ready access to the trap for cleaning out without disturbing the floor or concrete. It has an iron inspection man-hole running to the surface with tight, but removable

cover. It can be flushed out by hose or may be connected to the main water supply for flushing. It is made for either iron or clay pipes. There is no more sanitary fixture than this. It combines every requisite of a good sanitary trap and the same flushing and inspection idea is carried out in a large number of fittings made by this firm, who will send their catalogue upon application if you mention "Domestic Engineering."

Fetter-Baker-Niebuhr Co., La Crosse, Wis., have some work on hand in which they are using Cooper's Reno closets and other goods.—Adv.

DEPENDABLE BRASS GOODS.

The Farnan Brass Works, Cleveland, O., make a line of brass goods which they take pride in saying are to be depended upon. The illustration we show herewith is a sill-cock, which includes all the good points of their other patterns. It is of excellent design and finish and made of first-class material. Upon application, mentioning "Domestic Engineering," they will be glad to send their catalogue.



Wells-Newton Co., of Boston, are installing several of Cooper's Nautilus closets in various jobs they have on hand.—Adv.

A RELIABLE TRADE MARK.

"L & G" on steel sinks and other metal and enameled wares has come to be synonomous with "excellence." The Lalance & Grosjean Mfg. Co., of 19 and 21 Cliff street have lately issued a neat and convenient-shaped price list of their seamless wrought steel kitchen and pantry sinks, sink backs and plumbers' supplies. This comprehensive little catalogue is not being scattered broadcast, but the firm will be pleased to mail a copy to any one who will write and mention "Domestic Engineering."

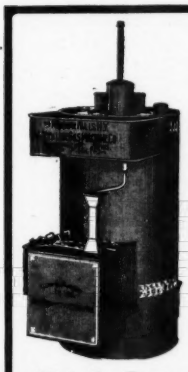
A PROSPEROUS FIRM.

Kieley & Mueller, manufacturers of steam heating and engineering specialties at 7 to 17 West 13th street, say that business for the past six months has been better than for some years previous. They are constantly bringing out new improvements on goods in their line.

FANS WATER FANS FOR DESK AND WALL ONLY

ELECTRIC FANS
FOR CEILING, DESK, WALL OR COLUMN
ANY VOLTAGE

SEND FOR CATALOGUE AND PRICES TO D. L. BATES & BROTHER, Dayton, Ohio



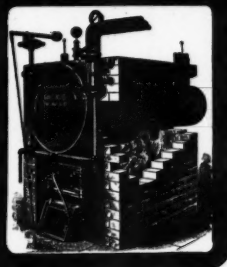
Write for Terms

The Niagara Falls Acetylene Generator

Like its patronym, **Powerful and Never Failing.** Costs less than any; attached to any house-piping; automatic in production. Really the best for agents.

Niagara Falls Acetylene Gas Machine Company.

NIAGARA FALLS, N. Y.



VANCE

FOR

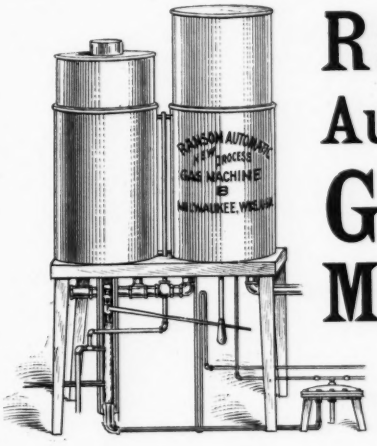
Steam and Hot Water Heating

FOR SOFT OR HARD COAL

Durable and Economical. We claim to save 33 per cent in fuel, as compared with other boilers.

Vance Boiler Works, Geneva, N. Y.

This is Not an Acetylene Gas Machine



Ransom Automatic GAS— Machine

Produces by a new process a clean, odorless gas for lighting, heating, cooking, power, etc., at a cost less than any other process.

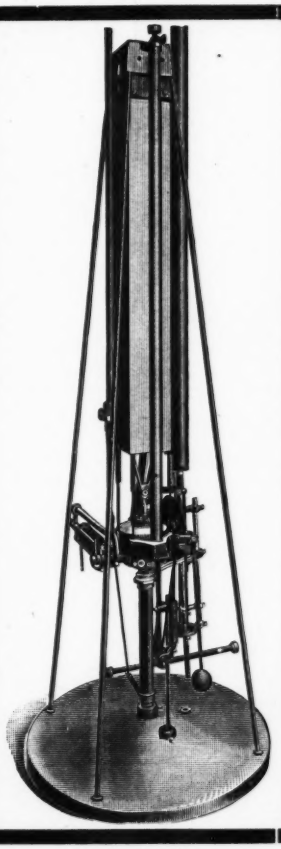
For Houses, Churches, Halls, Etc., It Has No Equal.

Make your own gas and save 50 per cent of what it costs you now.

The cheapest and best artificial light in the world is produced by the Ransom Gas Machine. Absolutely safe, being approved by Board of Underwriters. A 60 candle power light will not cost to exceed one-quarter of a cent per hour. Fifty cents per week will furnish sufficient gas to do your cooking. The Ransom has no equal. Agents wanted.

Ransom Gas Machine Co.

374 E. Water Street MILWAUKEE, WIS.



"The light so bright that birds will sing and say it is not night."

Agents Wanted

To Handle the

U.L. Generator

Generating from 1 to 50 lights of 100 candle power. Lights may be turned on or off in any room on any floor like gas jets. Automatic, self regulating generator.

Price, $125.00

Liberal Discounts to Agents. **For Terms and Territory address**

Universal Light Co.

26-28 North Canal Street Chicago, Illinois

Simple and Safe

No Competitors

A Big Money Maker

Gasoline Tank may be placed 100 feet from Generator

A Warning.

"Take Warning!" is the admonitory title of a folder which John A. Murray, of 625-7 Sixth avenue, is distributing in the interest of the Haggerty plumbers' furnace, an illustration of which appeared in "Domestic Engineering's" monthly issue for February. The second page contains a photographic reproduction of an article from the "Evening World" of January 29th, describing the instant death of a plumber from the explosion of a gasoline furnace. The "Haggerty" is made for safety and strength, and will, it is claimed, outwear several ordinary furnaces. So many orders have been received that the second shipment was all sold out before it arrived.

Put it down in Black and White the

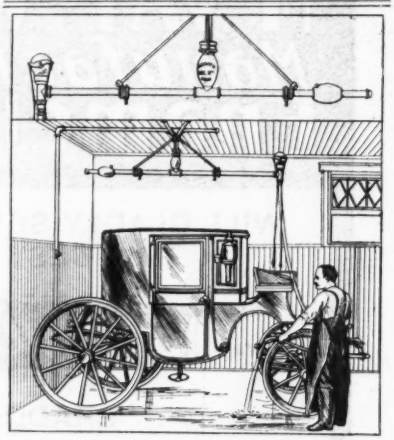
MONON ROUTE

IS THE DIRECT LINE BETWEEN

CHICAGO, INDIANAPOLIS, CINCINNATI AND LOUISVILLE

CITY OFFICE 232 CLARK ST., CHICAGO.

Swinging Hose Bracket



for Buggy Washing, Boiler Blowing, by water or steam, conveying liquids to different receptacles; useful in stables, factories, foundries, round houses, breweries, pickle factories, etc. A clever plumber will find hundreds of places for it. Agents wanted—Territory free.

L. T. Foreman & G. E. Beck

440 North 24th Street SOUTH OMAHA, NEB.

DESPER'S Specialties

Bracket Rings
for Range Boilers, Leave clear floor.

Elevator Water Register
Tells Water used on hydraulic elevators.

Soil Pipe Testing Valve
Cleverest of all.

Fresh Air Inlet Guard
Cannot be stopped up.

Balsago Soil Pipe Cement
Saves many broken Hubs.

Send for Specialty Circulars

H. A. DESPER
Worcester, Mass.

Lackawanna Railroad
MAGNIFICENT DAILY SERVICE BETWEEN
NEW YORK and BUFFALO
NEW YORK and CHICAGO
NEW YORK and ST. LOUIS
Tickets and reservations at 429 Broadway; 289 Main Street, Buffalo; 105 Adams Street, Chicago; Eighth and Olive Streets, St. Louis.
The Lackawanna Railroad presents unexcelled locations and opportunities for industries and manufactories.
General Offices, 26 Exchange Place, New York City.

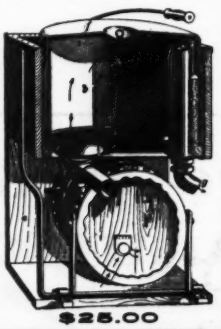
Sisson Insertable Joint
Indispensable to Plumbers
A friend in need is a friend indeed.

THE S. I. J.
FOR SOIL PIPE
Sizes 2 to 6 inches. Light and Heavy.
Makes a neat job and saves your patience.
ASK YOUR JOBBERS FOR IT

This does the trick.
MANUFACTURED BY
R. ESTABROOK'S SONS
SOUTH BOSTON, MASS.

Thomson's S. P. Smoke Machine

Has no glass gauges to break :: Cannot possibly force a good trap seal



$25.00

SCHENECTADY, N. Y., April 8, 1897.

Gentlemen: In reply to your request in regard to the working of the Thompson's S. P. Smoke Machine furnished by you for the Board of Health of this city, would say that it has proved to be equal to the guarantee made by you to the board.

Very truly yours, JOHN E. HARBINSON,
Inspector of Plumbing.

Write for our booklet, "*How to Test Plumbing*"

Gunster & Forsyth Mfg. Co.
Sole Manufacturers
Scranton, Pa.

Sole agents for Massachusetts
Dalton-Ingersoll Company, Boston

Canadian manufacturers
The Jas. Morrison Bros. Brass Mfg. Co.
97 Adelaide Street, Toronto

For sale by all trade jobbers

SCAIFE'S
Galvanized Iron Range Boilers.

Brazed Seams, Thoroughly Tested, Always Reliable.

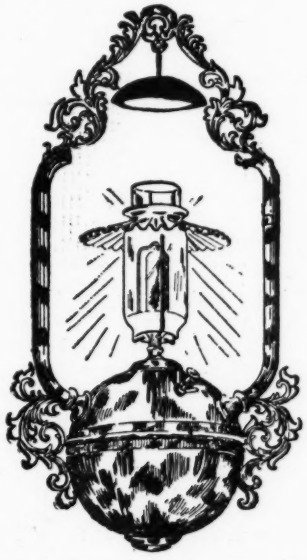
Heavier, Stronger, More Durable Than Any Others.

Localities having Severe Pressures should use only the SCAIFE BOILERS; they cost no more than others. Hundreds set in place over twenty years ago are still in use.
Complete Catalogue Mailed Upon Application.

WM. B. SCAIFE & SONS,
(Established 1802)
PITTSBURGH, PA.

The Lamp of Lamps

Sent on approval to the Trade.



500-Candle-power air-pressure "Search-Light" Vapor Lamp, costing One-Tenth of Electricity; also 100 candle power lamps in various styles.

GET CATALOGUE

Search-Light Mfg. Company

358 Dearborn St., Chicago, Illinois.

McVAY & WALKER
Manufacturers of Enameled Tubs.

WILL GLADLY SEND PRICES ON THE TWO BEST TUBS MADE.

Write Today. Unique and Eureka Prices will surprise you.

BRADDOCK, PA.

PLUMBERS' LEAD TRAPS

There are some pretty good reasons why plumbers should use The Western Brass Mfg. Company's Lead Traps, Bends and Ferrules, and why jobbers should handle them. Those who use and handle them know the reasons. Those who don't ought to. Better write right now.

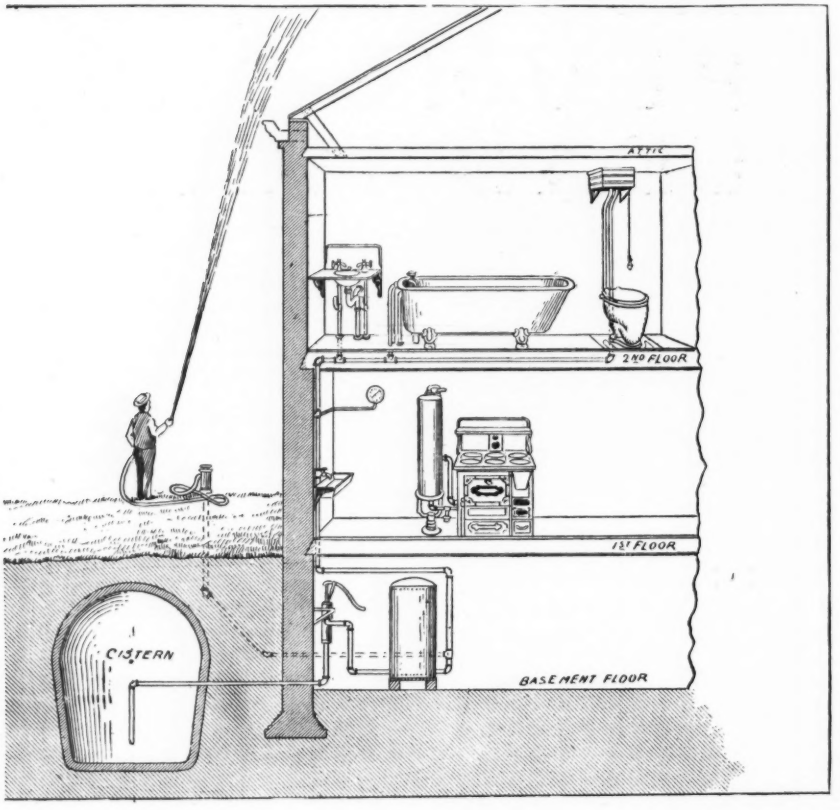
The Western Brass Manufacturing Co.
615-617 WALNUT STREET, ST. LOUIS, MO.

A New Automatic Flushing Urinal.

A patent has recently been issued for an automatic flushing urinal that appears to be the best thing of the kind that has been devised. Many attempts have hitherto been made to get an automatic flushing urinal that would be a success, but all of them have been practical failures owing to various causes. The intermittent flush has been without doubt the nearest to a success of any, but that has many defects, and platform and door attachments have all proved failures.

This new device is automatic, inasmuch that it flushes only when used, flushes by being used, and does not flush unless used. It has the appearance of success and will meet a long-felt want. The apparatus appears to be simple in construction and not necessarily expensive.

A. W. Hunter, North Adams, Mass., is setting one of Cooper's Nautilus in a residence in that city.—Adv.



Kewanee Pneumatic Water Supp'y.

A Pneumatic Water Supply.

The use of compressed air to elevate water or maintain it under pressure is quite general but the trade does not thoroughly understand as yet that it affords an opportunity for installing plumbing apparatus in detached buildings such as residences, manufacturing plants, public buildings where access to water mains is not possible. It is possible for the plumber now to install plumbing systems in entire subdivisions separated from water supplies, by the use of pneumatic water supply systems. We illustrate one of these systems herewith. It is manufactured by the Kewanee Pneumatic Water Supply Co., Kewanee, Ill., who have installed a number of them with very great success. From the illustration it will be seen that water is pumped in the bottom of an air-tight tank and as the water rises in the tank the air above it is compressed, the pressure increasing as the air is forced into a smaller space. The expansion of this compressed air forces water through supply pipes, the main supply being taken off at the bottom of the tank to the points where water is required. An hour's work with a hand pump stores up a supply of water to last the average family from ten days to two weeks.

The defect which has been complained of in the pneumatic system in the past has been that water under air pressure absorbes the air and holds it in expansion until the air is released, the water being filled with minute bubbles looks white or milky. While these bubbles disappear in a few seconds and the water resumes its normal color, the air is gradually withdrawn from the tank and the water line keeps rising until there is no air left. The Kewanee Pneumatic Water Supply Co., of Kewanee, has invented an automatic device which admits the air whenever it is needed and keeps the proportion of air and water correct. The mixing of the air with the water is a good thing, as it supplies oxygen to the water and keeps it sweet. The company has published a very interesting catalogue which they would be glad to send upon application, mentioning "Domestic Engineering."

Smith & Forbes, of Boston, are renovating the plumbing in Mr. A. W. Hart's residence at Brookline, using Cooper's Nautilus closet.—Adv.

Th5 "Triton" Radiator.

This illustration is a side view of one loop of the "Triton" two-column radiator, manufactured by the United States Radiator Co., Dunkirk, N. Y. Each loop contains four square feet of radiation,

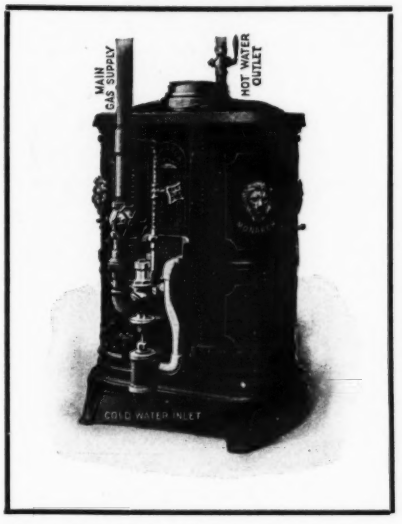
and when set the loops are 2½ inches apart. The design is an easy one to bronze and decorate and is kept clean without trouble. It is also made in three and four columns. A catalogue will be sent you if you write for it, mentioning "Domestic Engineering."

Chas. D. Fricka, of Philadelphia, is using one of Cooper's Reno closets in some repair work he has on hand.—Adv.

The "K. & M." Valve.

The illustration we give herewith is the standard globe valve as manufactured by the Kinsey & Mahler Co., of Peoria, Ill. In placing this valve on the market they have adhered to the standard list. The valve is well made of the best steam metal and is thoroughly finished and tested after the most im-

"MONARCH" LEADS



The "MONARCH" Automatic Instantaneous Water Heater, is the first and the best; in fact 'tis the "survival of the fittest".
Send for Catalog fully illustrated and you will be convinced.

MONARCH WATER HEATER CO.,
306 Wood St. Pittsburg
Robert B. Caverly, 504-506 Tenth St., Washington, D. C.

THEORY AND PRACTICE OF
LEAD BURNING
By the Autogenous Process
OR HOW TO SOLDER WITHOUT SOLDER

With full instructions to the amateur in the details of the machine and the management of the gases, with valuable suggestions and directions for practice

BY AN EXPERT
Every Plumber Should Have This Book
PRICE, BY MAIL, $1.00
Domestic Engineering, Chicago

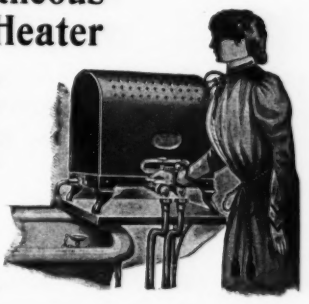
The GENESEE No. 10
Frost Proof Automatic Water Closet

For outside locations where other closets will freeze. Perfectly frost proof in zero weather. Tank and pipes always empty except when closet is in actual use. Cannot be used without discharging itself; no water left above frost line.

Ask for catalogue of other goods.

Genesee Automatic Closet Co.
ROCHESTER, N. Y.

The Victor Instantaneous Water Heater



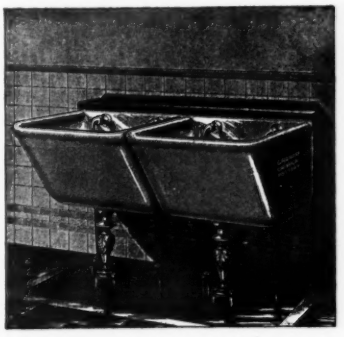
is the cheapest, the most efficient and the neatest water heater made. It occupies but little space and is always ready, furnishing hot water in a few seconds, day or night.

The Victor received the highest award at the Omaha Exposition in 1898.
Write for descriptive circular, prices, discounts, etc.

W. J. ADAM....JOLIET, ILL.

HAVE YOU SEEN
LAWSON'S
GAS WATER HEATER?
EFFICIENT, ECONOMICAL, COMPACT, MADE IN 3 SIZES.
Can be readily attached to an ordinary boiler at a very small cost.
Circulars gladly sent on application.

L. S. LAWSON, Mfg., 222 EIGHTH AVENUE HOMESTEAD, PA



Good Goods Only at Factory Prices.....

Good buyers want to know what that means. They may learn by asking for a catalogue of our imperishable Sanitary Laundry Trays and Sinks.

Chas. Graham Chemical Pottery Works
986-1018 Metropolitan Avenue,
Brooklyn, New York.

"Let Well Alone", is a dangerous proverb for business men. You can increase Your Trade by advertising in

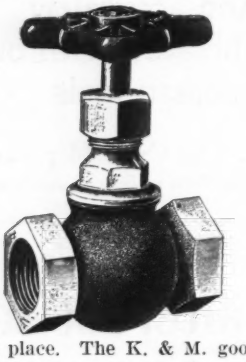
DOMESTIC ENGINEERING.

Cheer up, Jack! Don't be a Lobster!

The Seiben Floor Drains
are the best that ever. They save digging a deep ditch. Calking of joints. Extra fittings. Hours time and grief. No stoppage of sewers. No evaporated trap seal. No back water and need no vent pipe. They are made with or without back water valve. Ask your jobber or write for our new catalogue.

THE SIEBEN MFG. & SUPPLY CO.
1120 Holmes Street
KANSAS CITY, MO.——————U. S. A.

proved methods. Engineers well know that the expense in replacing defective valves is greater than the cost of the valve itself, and this will be the reason why high-grade goods should be used in

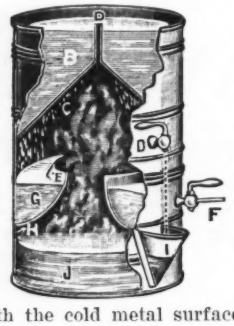


the first place. The K. & M. goods are fully described in a handsome catalogue which they will send upon application if you write, mentioning "Domestic Engineering."

Thos. B. Dale, of Philadelphia, is setting one of Cooper's closets in a large house in Germantown.—Adv.

WATER PURIFICATION.

There are many cities in which the water supply is dangerous. Plumbers who carry a line of water filters could also just as well sell a large number of water stills for distilling water, which renders it absolutely pure. We show herewith a sectional view of a water still. In operation this still is set on the stove, filled with water, which is soon converted into steam, which upon rising leaves the boiler chamber and enters the condensation chamber, comes into con-

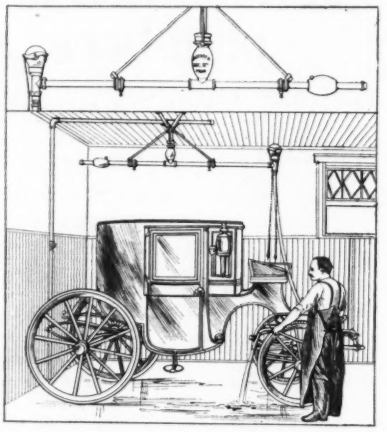


tact with the cold metal surface, which forces it back into water, thus creating a vacuum, drawing in sterilized air and revitalizing the distilled water. There can be no disease germs, sewage or health-wrecking microbes left in the water after distillation. This is automatic and requires no amchinery or attachments, and is useful in every house. It can be secured in very large quantities by plumbers, of the manufacturers, the Health & Comfort Supply Mfg. Co., Cincinnati, O., who desire agents and will be glad to have you correspond with them, mentioning "Domestic Engineering."

H. H. Russ & Son, of Albany, N. Y., have some work on hand in which they are setting one of Cooper Brass Works' Nautilus closets.—Adv.

THE SWINGING HOSE BRACKET.

Last month we published an illustration of the private stable of E. A. Cudahy, of Omaha, Neb., showing Foreman and Beck's swinging hose bracket in operation. Lest our readers should think that carriage washing is the only use to which this bracket can be put, we beg to state that Mr. Foreman's thirty years' practical experience as a plumber from the Atlantic to the Pacific, and thirteen years' experience on the Pennsylvania Railway between New York and Pittsburg, and two years' experience on the Union Paficic from Omaha to Ogden, has shown him many places that this device can be used. It saves hose, time and one-third of the water. This last is an important feature where water



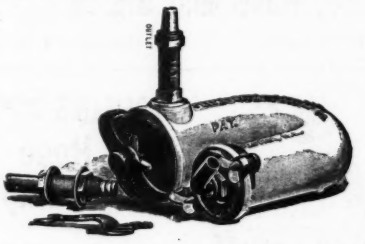
meters are used. In boiler rooms it will be a saving of hose, extra valves and water, steam and air can be connected and in most places where there is a battery of boilers one bracket will reach three boilers. There is a large demand for it in big foundries, glass works, roundhouses and breweries, where it can be tinned and lead-lined, where they wish to run acid through it. They can be attached to steam connections to clean them out. There is no rubber packing to burn out.

Mr. Foreman will dispose of his interest in this patent by territory or right to manufacture on royalty. He is covered by patents issued in the United States on Sept 1, 1896, and Dec. 11, 1900, and has patents pending in Great Britain and Canada. In writing address L. F. Foreman and G. E. Beck, 440 N. 24th St., South Omaha, Neb.

Thos. E. Sharpe, of Boston, is making some additions to the plumbing in H. A. Graham's house at South Sudbury, using Cooper's Nautilus.—Adv.

THE SEASON TO SELL BEER COOLERS.

We are now coming into the beginning of spring, and the hot weather of summer is not far away. Plumbers who make a specialty of doing saloon work will have plenty of opportunity to install this fountain beer cooler, which is said to be a great improvement over the coil pipes. It is porcelain enameled inside and out, can be opened and washed out, and holds as much as a twelve-foot coil. The container is made of cast iron enameled; all other parts that come in contact with the beer are cast brass tinned.



Every part of the cooler is removable, so that it can be entirely cleansed. It fills and empties the same as a coil cooler and requires the same amount of ice. The cooler gives no metallic taste as is given by coils. Those who have used these coolers pronounce them a great improvement over the coil pipes, there being no slimy sediment deposited as is the case in the pipes. City and county agents are wanted, and plumbers who are in position to undertake saloon work will find this a very desirable addition to their line. Territory will be assigned free upon application to the Seitz Beer Cooler Co., Peoria, Ill., mentioning "Domestic Engineering."

F. W. Pripps, of Milwaukee, is installing some more of Cooper's Reno closets with Atavic flushing valves.—Adv.

THE BENEDICT NICKEL TUBING.

This is a tubing which is the same color all the way through. You cannot rub the surface off, leaving it brassy, but the more it is rubbed the more silvery white it becomes. Upon application to the Benedict & Burnham Mfg. Co., Waterbury, Conn., they will send their illustrated book on "Benedict Nickel."

Dunkerton & Benedict, Syracuse, N. Y., have a job of plumbing on hand in which they are using Cooper's goods.—Adv.

THE DENNEY IMPROVED RIDER PUMPING ENGINE.

This illustration shows the Denney improved Rider hot air pumping engine, built by the American Machine Co., of Wilmington, Del. Its improvements include detachable brackets for fly-wheel bearings, obviating the necessity of purchasing new and expensive cylinders when the brackets are broken; self-oiling boxes for fly-wheel journals; connecting rods with a complete set of independent crank and knuckle pin brasses, which are capable of fine adjustment, taking up the wear and keeping the connecting rods of uniform length, avoiding the possibility of the pistons striking the heater pot or foundation bed plate. When these brasses become too much worn for further adjustment, a new set may be purchased, making the rods as good as new, while on the old engines new connecting rods have to be bought; oil wells on top of cylinders

OAKUM PACKING AND ROPE

Planet Mills Mfg. Co.

335 Carroll St. BROOKLYN, N. Y.

REDFIELD'S Wrought Steel Strong, Light and Pliable, Perfect Inner Circle Will not leak **Hose Clamps**

MANUFACTURED BY

J. R. CLANCY, SYRACUSE, N. Y.

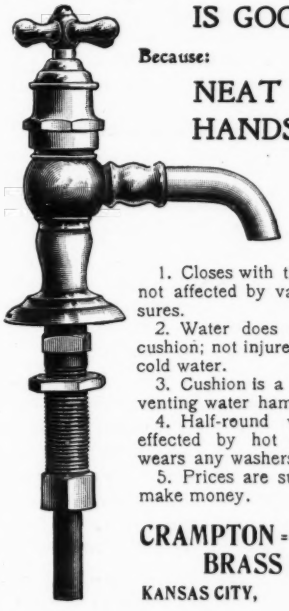
Farley S. G. Work

IS GOOD.

Because:

NEAT AND HANDSOME

AND



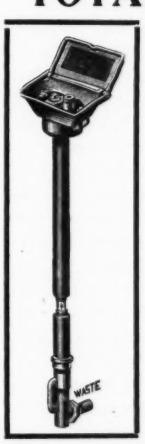
1. Closes with the pressure; not affected by varying pressures.
2. Water does not touch cushion; not injured by hot or cold water.
3. Cushion is a spring; preventing water hammer.
4. Half-round washer not effected by hot water; outwears any washers made.
5. Prices are such that you make money.

CRAMPTON-FARLEY BRASS CO.

KANSAS CITY, MO.

"TOTAL ECLIPSE"

Hydrants and Street Washers



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Guaranteed to give entire satisfaction

We also make all styles of "McNAMARA" PATTERN HYDRANTS

Carried in stock by all Jobbers

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JOHN G. KUPFERLE

ST. LOUIS

Steel pipe is easily and accurately threaded with our modern tools

The Oster Mfg. Co.

8 East Prospect Street, Cleveland, Ohio

Points which are of interest to plumbers

WE GIVE YOU WHAT YOU WANT WHEN YOU WANT IT AND AT THE RIGHT PRICE

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SUGGESTIONS Plumbers' Torches, Thawing Steamers, Closet Repair Connections, Plumbers' Furnaces, Steam hose, etc., etc.

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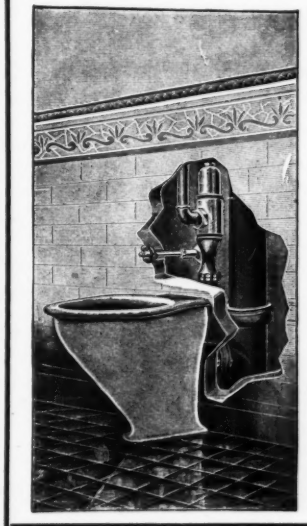
WE HANDLE EVERYTHING IN PLUMBING, GAS, STEAM AND WATER SUPPLIES

Have you our Catalogue, Memorandum Book and Calendar?

SANITARY SPECIALTY MFG. CO.

55-57 North Clinton Street 24-30 Milwaukee Avenue CHICAGO, ILL



National Enameled Iron Jail Closet

Simple, durable and easily adjusted. No overhead tanks required. Cannot be tampered with—no movable parts being exposed.

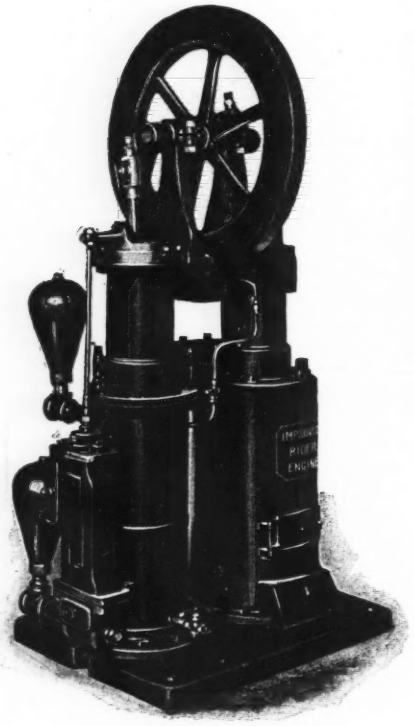
MANUFACTURED BY

The National Supply Company

TOLEDO, OHIO

to retain oil for packings; pump rod stuffing boxes fitted with lamp-wick packing; furnaces lined with brick; adjustable wooden lugs on the bottom of the compression piston. Years of experience and constant complaints by users of other engines led to the adoption of these lugs, and they are so valuable that they have been covered with patents. They render the engine practically noiseless, decrease friction and increase power. When too much worn for further adjustment, new ones can be readily made or bought at a cost of a few cents. Other engines have the lugs made of iron cast on the piston, and when they are worn out it is necessary to buy a new piston.

The pumps for the Rider engine are made in two styles, one with single acting flat valve for ordinary work and the



other with double acting roll valve, where the water rises naturally to the valve, as is the case where city pressure is available. This latter style is used in cities to force water up to the top stories of high buildings where the city pressure is not sufficient to do it. These engines are engine and pump complete, and it is not necessary to buy anything in the way of a separate pump to go with the engine. Upon application mentioning "Domestic Engineering" catalogue D-1901 will be sent, which describes this and other styles of engines.

Dixon & Ballou, of Buffalo, are renovating the plumbing in a large residence in that city, using Cooper's Nautilus closet.—Adv.

Patterns for Heaters.

The Gobeille Pattern Co., of Cleveland, O., make a special business of constructing patterns for steam and hot water heaters. All manufacturers of such goods who desire new patterns should correspond with them.

R. W. Applegate, Woodsfield, O., is using some of Cooper's goods in a large job in that town.—Adv.

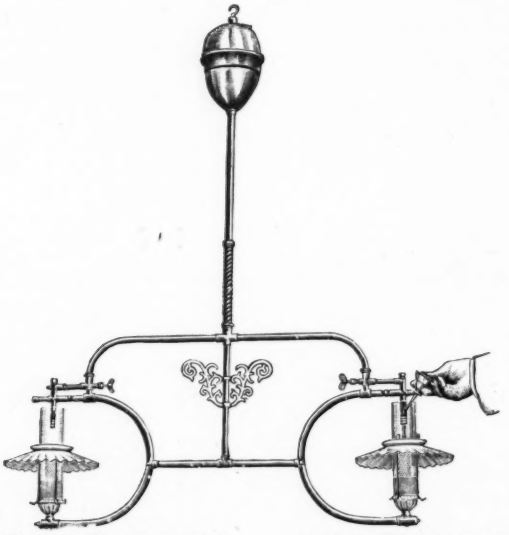
Lighting Appliances.

I. P. Frink, 551 Pearl street, New York City, has behind him years of experience and successful practice in manufacturing lighting appliances for large rooms, store windows and similar purposes. His catalogue should be in the hands of every dealer in gas fixtures.

O. C. Davis, Racine, Wis., has a new bath-room on hand in which he is using Cooper's fixtures.—Adv.

A Self-Lighting Lamp.

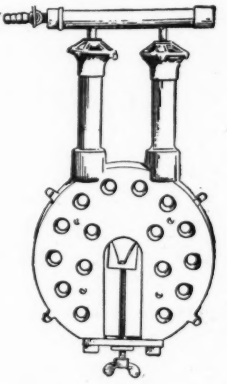
The illustration is of the American self-lighting lamp No. 3, for large rooms, stores, halls, etc. This is said to be the only lamp of its kind on the market. It gives a beautiful light, at the lowest cost known. The fixtures are made of hard brass polished, with gold finish. The lamp combines all the advantages and eliminates the defects of other lamps. It will operate in cold weather. With the patent air receiver the lamps are not affected by draft and wind as are most gasoline lamps. With this lamp there is no leak, no odor, no smoke. It gives a bright, soft light, and is most



desirable for dwellings, halls, stores and in places where a strong, brilliant light is in demand. It generates gas instantly and every lamp is fully warranted to give perfect satisfaction. It is very little more trouble to light this lamp than common gas. Upon application to the manufacturers you will receive a circular showing four styles in which the lamps are manufactured, three of them being single burners. Please mention "Domestic Engineering" when writing.

The "Heller" Heater.

J. P. B. Sadtler & Co., 813 S. Howard street, Baltimore, Md., manufacture this range boiler water heater, which is an economical and common sense heater, to be placed underneath range boilers to supply the kitchen and bath room with hot water whenever desired. It takes the place of the kitchen range so far as



water heating is concerned and does the work a great deal better. We have seen this heater operate and know that it does its work in a perfectly satisfactory and economical way. Upon application the manufacturers will be glad to send circular showing styles, price and size of this device.

H. S. Householder, York, Pa., has some repair work on hand, in which he is using one of Cooper's Nautilus closets.—Adv.

A Neat Memorandum Book Free.

The Sanitary Supply Mfg. Co., 55-57 N. Clinton St., Chicago, Ill., are sending out free of charge upon application, mentioning "Domestic Engineering," a neat order book for the pocket or desk.

A Private Postal Card Order Book.

The Utica Heater Co., manufacturers of hot air furnaces and steam and hot water boilers, of Utica, N. Y., will send to the trade upon application a postal card order book in which twenty-five

TAKES WELL!

Hundreds of Plumbers busy putting in

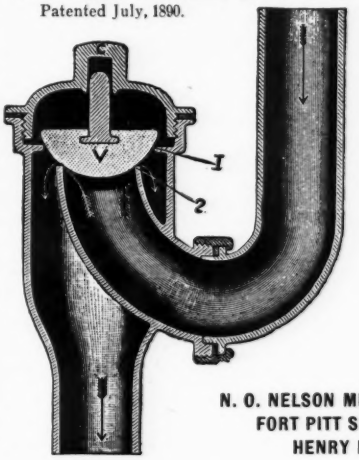
KOSIOL'S WASTES

Be the first to introduce it in your town or city
Send **$2.50** for sample.

L. KOSIOL
514 Second Street, Louisville, Ky.

THE SECURITY TRAP

Patented July, 1890.



Seal: Cannot be reduced in any degree by most severe syphonic action.

Evaporation: Ball rests in such a way that it is impossible for water to evaporate.

Back pressure: Positively safe against it.

Noise: No roaring.

GET PRICES.

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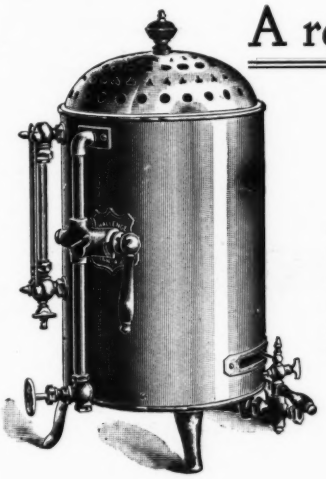
211 S. Ninth St.
PHILADELPHIA, PA.

N. O. NELSON MFG. CO., St. Louis, Mo.
FORT PITT SUPPLY CO., Pittsburg, Pa.
HENRY McSHANE MFG. CO., Boston.

A record breaker



Boils water in
1½ minutes

This heater with gas attachments for heating water to a high temperature with unequalled rapidity and economy cannot be surpassed by any heater on the market. Adapted for bath rooms, etc. Send for catalog.

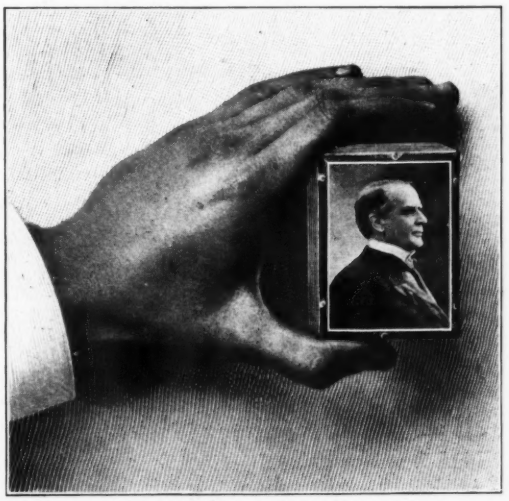
Challenge Mfg. Co.
South Norwalk, Conn.

S. P. STAMBACH. ROBERT LOVE

Stambach & Love

Plumbing Supplies and
Sanitary Specialties

50 AND 52 N. SEVENTH STREET
PHILADELPHIA



Here's an "Eye Catcher"

IT'S A CUT—one of the sort of illustrations we are making every day for advertisements, booklets, catalogues, etc. We make them in half-tone or line, from photographs, drawings, or direct from the articles. We have a plant and a force that give our customers great advantages in quality, time and cost.

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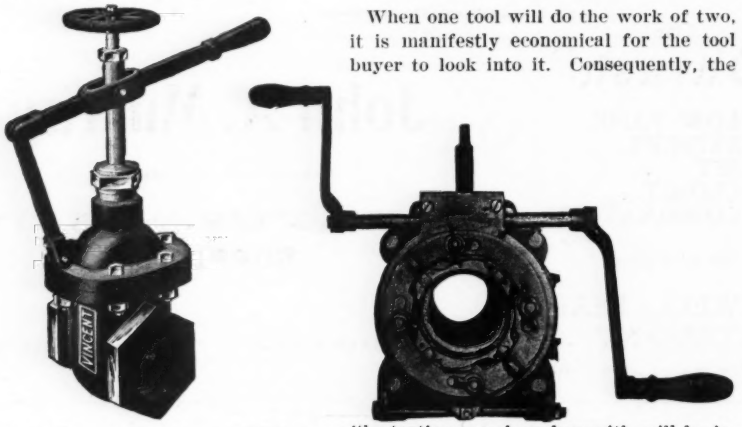
Seventh and Chestnut Streets, Philadelphia, Pa.

private postal cards are interleaved with sheets which correspond with the printed matter on the card. By using a carbon paper, which is supplied with the book, orders may be written on the postal cards, which may be then mailed and copy of the order retained. This is one of the most useful order books we have seen, and upon application mentioning "Domestic Engineering" a copy will be sent free of charge.

Stradling Plg. & Htg. Co., of Utica, N. Y., are setting one of Cooper's Nautilus closets in a house in that city.—Adv.

A Quick Opening Valve.

This illustration shows the quick opening valve known as the "Vincent." There are places where quick opening valves have to be used. This one can be locked

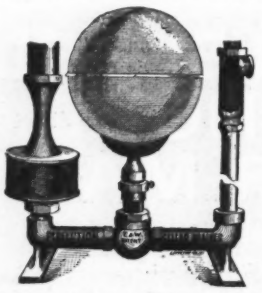


immediately. It has the adjustable wedge which is characteristic of all "Vincent" valves. Upon application to Sweet & Doyle, Cohoes, N. Y., circulars describing this and other valves sold by them will be sent if you mention "Domestic Engineering."

Sharp & Thompson, Atlantic City, N. J., are plumbing the residence of Dr. Filbert, at that place, using Cooper's Reno closets, Special baths, lavatories, and other goods.—Adv.

Cellar Drainer Time.

This is the time when big thaws, full streams, moist soils, and other over wet conditions cause cellars to fill up, cause excavating to be difficult, wheel pits to



get full of water, etc. This cellar drainer, manufactured by Irwin & Welch, 35-37 S. Canal street, Chicago, Ill., is an automatic device which starts when it is necessary to drain water and stops when the water is out of the way .It is operated by either water or steam pressure, and upon application circulars will be sent describing it and giving the price.

John C. Read, Omaha, has a nice job of plumbing on hand, including the installing of one of Cooper's famous Nautilus water-closets.—Adv.

New Radiator Price List.

The Holland Radiator Co., 38 Dearborn street, Chicago, Ill., is sending out a discount sheet on their full line of radiators, and if you have not received one, they will be glad to have you write for one, mentioning "Domestic Engineering."

James Openshaw has some repair work on hand in which he is using one of Cooper's Nautilus closets.—Adv.

Save Your Tools.

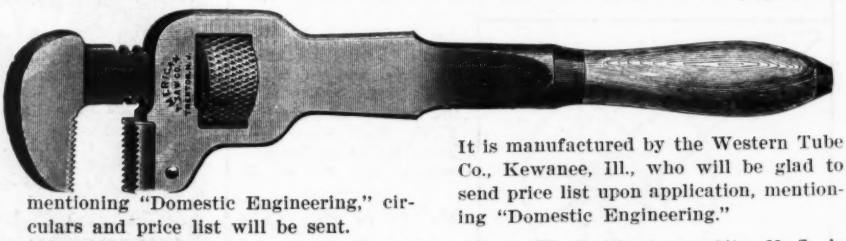
When one tool will do the work of two, it is manifestly economical for the tool buyer to look into it. Consequently, the

illustration we show herewith will be interesting. It shows one style of the combined vise and screw cutting machine made by Hickman-Melhorn Co., 200-208 Liberty street, Pittsburg, Pa., who will send circulars upon application, mentioning "Domestic Engineering."

New York Plumbing Co., Council Bluffs, Ia., have two nice jobs on hand, in which they are using Cooper's closets and other goods.—Adv.

The "Triumph" Wrench.

This is one of the wrenches made by the American Saw Co., of Trenton, N. J. A superficial examination shows the advantages of this wrench. It will not lose pipe, and can be used as a monkey-wrench or pipe-wrench. Its removable jaw is a great feature. Upon application,



mentioning "Domestic Engineering," circulars and price list will be sent.
its grip, it will not crush or lock on the

Bellamy & Hornung, of Omaha, are setting a Nautilus closet in a large house in that city.—Adv.

Radiator Bronzes.

J. Morsching & Co., 27 Park Pl., New York City, make a special business of manufacturing bronzes in gold, aluminum and all colors. Upon application they will be glad to send samples, prices and circulars, if you mention "Domestic Engineering."

Stephan Bros., Council Bluffs, Ia., have a nice job on hand in which they are using two of Cooper's low-down closets.—Adv.

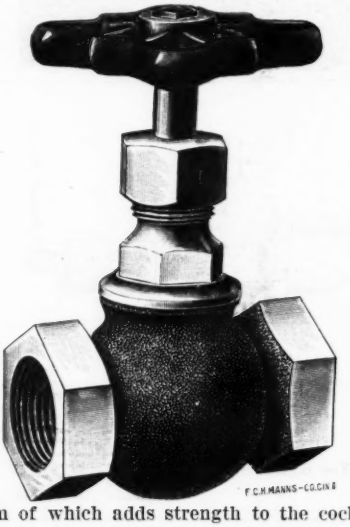
A Tasteful Calendar.

We have nothing but pity for people who send out nothing but tasteless calendars, some of them even approaching vulgarity, but the calendar we have received from Elmer S. Stock, plumber, 63A Dover street, West Somerville, Mssa., is a beautiful and tasteful contribution to calendar literature. We do not know whether Mr. Stock can afford to send many of these out, but if you write, mentioning "Domestic Engineering," and Mr. Stock feels rich when he gets your letter, you may possibly get a copy.

McKinley & Northwood, of Ottawa, Ont., are installing two of Cooper's Nautilus closets in a residence in that city.—Adv.

Iron Cocks.

The illustration herewith shows an improved design in iron cocks, the construc-



tion of which adds strength to the cock and provides a larger plug containing an opening the full area of the pipe. They are made to withstand heavy pressure. It is manufactured by the Western Tube Co., Kewanee, Ill., who will be glad to send price list upon application, mentioning "Domestic Engineering."

H. A. W. Smith, Ocean City, N. J., is plumbing the house of Mr. Cresse, at that place, using Cooper's finest goods throughout.—Adv.

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Plumbers' Steam and Gas Fitters' Supplies

WAREHOUSES:
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OFFICE: 359 PEARL ST.,
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John Simmons Co.

110 Centre Street
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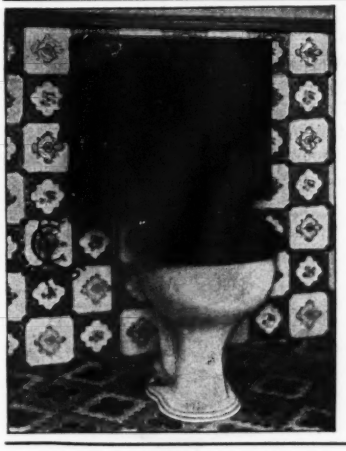
TRADE MARK

IRON PIPE, FITTINGS AND VALVES
FOR THE PLUMBER, STEAM- AND GAS-FITTER.

CAST-IRON SOIL PIPE
DRAINAGE FITTINGS
IMPROVED BATH-ROOM FIXTURES



"The Thrush, enrapturing heaven and earth."

THE "Thrush"

LOW TANK
SYPHON
JET
CLOSET
COMBINATION

We have others.

COLWELL LEAD COMPANY
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Telephone 640—38th Street
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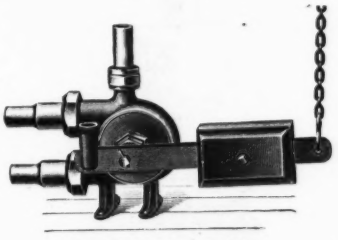
PLUMBERS', STEAM AND GAS FITTERS' SUPPLIES

625 AND 627 SIXTH AVENUE NEW YORK



Patented July 24, 1900.

Try It

and you will use no other.

ASBELL'S
FROST PROOF
HOPPER VALVE.

SEND FOR DESCRIPTIVE CIRCULAR AND PRICE.

THE S. J. ASBELL COMPANY
Van Houten St., near Cross St., PATERSON, N. J.

Mention Domestic Engineering.

Metropolitan Supply Co.

Manufacturers and Dealers in

Plumbers' Specialties
Plumbers' and Steam Fitters' Supplies

511 Grand Street, New York City

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Plumbers can save time and money by using our Nickel Plated Flush Pipe Elbow

WIRT'S ALL IRON HOSE REELS

Are cheaper than Wooden Reels. They look better, last longer and give better satisfaction. They are the best for all purposes. Wirt's Wall Reels and Hump Racks for fire protection.

Wirt & Knox Mfg. Co.
219 N. Third St.
PHILADELPHIA, PA.

Our Discounts are Liberal

WATER SUPPLY WITHOUT WATER MAINS

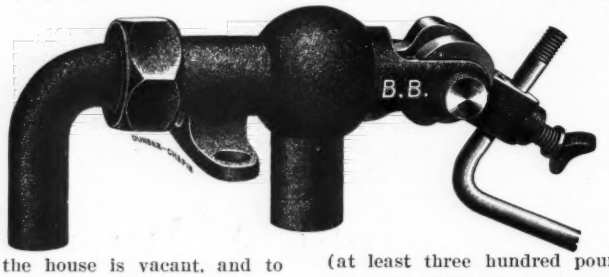
The Kirtley Patent Domestic Water Service supplies country, village and suburban homes, business and public buildings with water supply where water mains are not accessible. Greatly increases a plumber's chance to do business. Write for descriptive circular.

GEO. P. KIRTLEY & CO., 1213 Walnut Street, Kansas City, Mo.

THE "B. B." BALL COCK.

The B. B. high-pressure ball cock which we show herewith has many advantages. Some of these are:

It has no cup packings, the seat packing being the only packing used: This can be readily re-packed with a piece of leather. The removable brass seat is made of the best quality of steam metal, which can be readily re-dressed by the plumber or renewed without removing the cock from the tank. Its ground joint coupling is always tight. There is no washer to dry up when the water is shut



off, while the house is vacant, and to cause damage by leaking when the water is turned on. It has no pin-hole water ways to back pressure chambers to clog up and render the cock useless, causing the tank to overflow. It closes against the pressure, consequently there is no water hammering. All parts are solid and substantial, consequently there is no singing or whistling. The roller-bearing lever on the cam reduces the friction to the lowest possible amount. Upon application, mentioning "Domestic Engineering," the Boston Brass Co., 40 Oliver street, Boston, Mass., will send a catalogue of their supplies, which includes this as well as many others.

Jas. A. Trane, La Crosse, Wis., has several nice jobs on hand in which he is using Cooper's Nautilus closets.—Adv.

GOODS FOR COMPLYING WITH FIRE REGULATIONS.

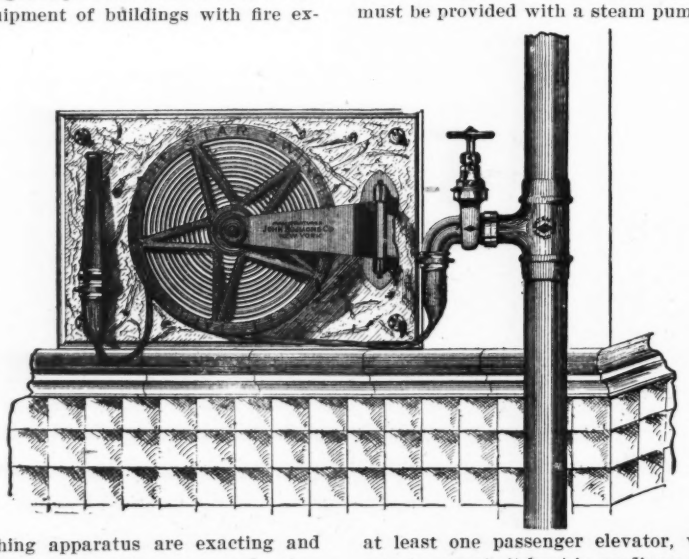
The legal requirements in New York for the equipment of buildings with fire extinguishing apparatus are exacting and stringent in their character, and very properly so, in view of the large and constantly increasing number of sky-scrapers in the Greater City.

Every building already erected which is more than nine stories, or exceeding 100 feet in height, and not higher than 150 feet, if not already provided with a standpipe at least three inches in diameter, must be equipped with a standpipe having a diameter of four inches. If the height of the building exceeds 150 feet it must be furnished with a six-inch standpipe.

The material used must be of a quality sufficient to stand the necessary pressure (at least three hundred pounds to the square inch) to force water to any of the floors of the building or to the roof; the pipe to extend from the cellar to the roof, with a two-way three-inch standard fire department siamese connection placed on the street above the curb level, and connected to the standpipe. These standpipes are to have valves and two and one-half inch outlets of the regular fire department pattern and thread, with hose attached, on every floor.

Buildings used for business or manufacturing must have also a row of one and one-half inch perforated iron pipe for every ten feet of width, or street frontage, placed six inches under the ceiling of each story below the first, with a valve near the standpipe and an outside three-inch siamese connection, so that water may be let into the pipes by the firemen if necessary.

All buildings more than 150 feet high must be provided with a steam pump and



at least one passenger elevator, with a man to operate it kept in readiness during all hours of the day and night, including Sundays and holidays, for immediate use by the fire department.

In order to meet the demand for a class of goods that are thoroughly reliable and in every way up to the requirements of the law and the fire department, the John Simmons Co. are carrying, at their warerooms, 106-110 Centre street, a line of piping, valves, connections, hose, hose-reels, chemical extinguishers and other specialties that it would be practically impossible to improve upon. A "Domestic Engineering" representative enjoyed an instructive conversation a few days since with Mr. F. V. Forster, the experienced and efficient manager of this very interesting department. Mr. Forster explained that their piping, in order that it may stand every test, is made of the best malleable iron; their connection joints for hose attachment on each floor are admirably contrived with a smooth inner surface and a gradual reduction of the size of the "bore," so that there is no "shoulder" and the least possible amount of friction to interfere with the force of the stream of water. Their linen hose is the strongest and most durable made, there being no rubber or other perishable material to crack or decay. This hose has successfully been subjected to the most crucial tests by the Factory Mutual Fire Insurance Companies. Their portable chemical extinguishers are simple in construction, easy to operate and most effective in execution.

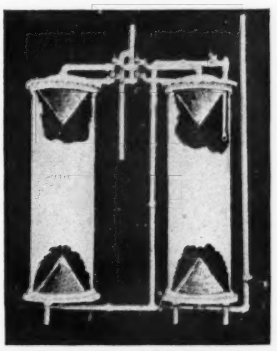
Henry Jackel, of Philadelphia, is renovating two bath-rooms in Mr. Robert Pilling's residence in Frankford, using Cooper's Nautilus closets, Special baths, lavatories, etc., throughout.—Adv.

BARNARD BOILER.

We show illustrations of the Barnard boiler. The first shows the boiler for steam as set up for asbestos jacket, the second shows the boiler brick set. The boiler is also made for hot water. It is a simply constructed boiler, made entirely of cast iron, composed of sections, each section being a boiler in itself, and the joints of these sections are planed true and made absolutely tight. If, through carelessness, a section becomes broken, no serious damage can result. This boiler combines the best points of two of the most economical boilers known to engineering science, viz., the locomotive boiler, in which the fire is surrounded by water (except on the under side, where the grate bars are), and it passes the heat three times through the entire length of the boiler, as in the marine type. These points make a boiler economical in the use of fuel. The sections are mounted on cast iron side pieces, securely placed together to form a firm foundation. One of them contains the soot doors for removing dust and soot. The grates are of the rocking and dumping pattern.

In the No. 2 boiler hard coal, coke and wood can be used to advantage, but not soft coal. The No. 3 boiler will burn

THE ECLIPSE DUPLEX FILTER



Easily and thoroughly cleaned with Filtered Water.

No Alum or Coagulent used for Clarifying

Send for catalogue and hundreds of references on the best filter made in the U. S.

ECLIPSE FILTER CO.
Philadelphia Bourse

WE CAN SAVE YOU MONEY

Cooper's Adjustable Drain Trap

Has a 4-inch Seal and is an absolute protection against Sewer Gas. $1.75 to $2.00 SAVED ON EACH TRAP. Write and we will show you how to make money.

Libbey, Parker & Co., = Boston

Sales Agents for Libbey Drip Valve, Victor Ball Cock and Victor Brass Pipe Hanger.

Send for Catalogue.

RELIABLE TINNERS' FURNACE

MADE BY

The SCHNEIDER-TRENKAMP Co., Cleveland, Ohio.

SOMETHING NEW

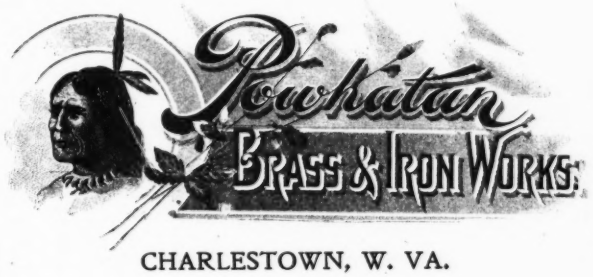
Vanderman's Adjustable Fitting for Connecting Soil Pipe

Send for Catalogue and Price List of Plumbing and Heating Specialties, or order through your Jobber.

Freight allowed on the Adjustable Fittings, East of the Mississippi river, on a dozen of one or assorted sizes.

MANUFACTURED AND FOR SALE BY

THE VANDERMAN PLUMBING AND HEATING COMPANY
Willimantic, Conn.



CHARLESTOWN, W. VA.

Brass and Iron Goods for Plumbers, Steam and Gas Fitters

THE WILHELMI | THE MODERN

two best boilers

The "Wilhelmi" is a high grade copper range boiler tested to 250 lbs. There can be no better boiler made : : : : : :

The "Modern" is for use where the pressure does not exceed 100 lbs. It is guaranteed against collapse : : : : :

Very attractive discounts furnished

Hayes Mfg. Co., Paterson, N. J.

The McGuire Adjustable

ROOF FLANGE

No. 1. will adjust from ¼ pitch to ½ pitch
No. 2. will adjust from flat to ½ pitch

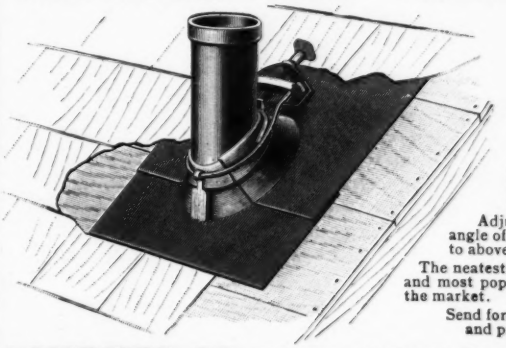
Made for Standard and Extra Heavy Pipe in copper and Galvanized Iron. Only two sizes to be carried in stock as the adjustments fit all angles.

For Prices, etc., apply to

KENDRICK VALVE AND WASHER COMPANY,
SYRACUSE, N. Y.

The above cut shows our No. 1, ¼ to ½ pitch

HAVE YOU SEEN IT WORK? IT IS A MARVEL.



Two-Part Acme Roof Flange

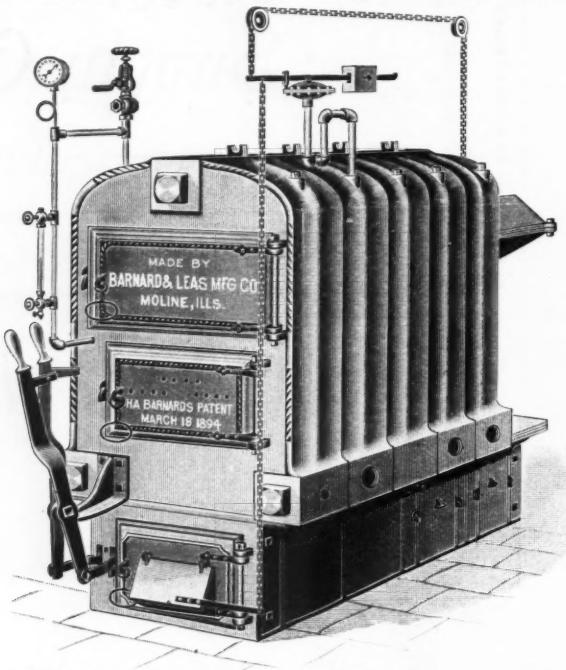
Adjustable to any angle of roof from flat to above 45 degrees.

The neatest, most unique and most popular flange on the market.

Send for catalog and prices.

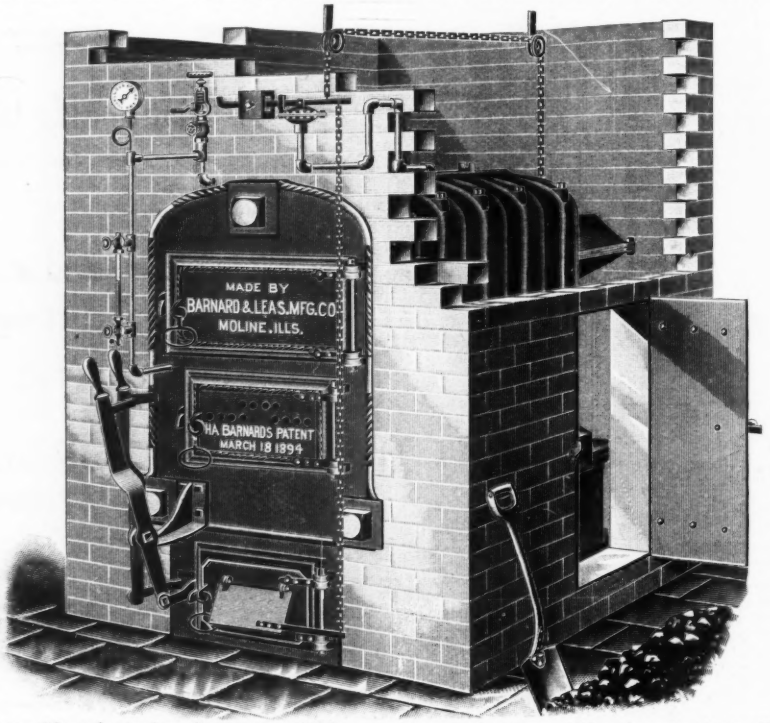
ACME MFG. CO., WEST SOMERVILLE, MASS.

hard coal, coke, wood and soft coal also, if provided with a good draft. Some people who are using the No. 3 boiler with slack get good results. The No. 2 boiler is made in twelve sizes, carrying



from 600 to 1,900 feet of radiation, the No. 3 boiler is made in twelve sizes, carrying from 400 to 1,700 feet of radiation.

The boiler is manufactured by Barnard



& Leas Manufacturing Company, of Moline, Ill., who have just completed a beautiful catalogue, which will be sent on application if you mention "Domestic Engineering."

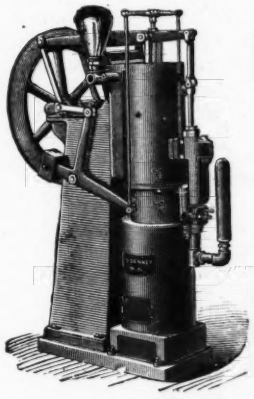
A New Water Filter.

To supply the constantly increasing demand for water filters for household use, the Champion Safety Lock Co., of Cleveland, Ohio, have added another filter to their large line, which consists of filters for use in households, hotels, restaurants, hospitals, on bars; and also in the manufacture of drugs, chemicals and by bottlers. The drawback to the use and sale of faucet filters, has been the necessity of removing them from the faucet to obtain unfiltered water. The Champion No. 10 germ-proof water filter overcomes this objection by the outlet for unfiltered water at the bottom, as shown in the accompanying illustration. This outlet also permits the water which has been standing in the filter and become warm, to be drawn off, and thus

cool, filtered water is immediately obtained. By the use of a very simple attachment the filter can be used on a plain faucet, Fig. 2. The chain holds the filter securely and a rubber disk makes a tight joint. The filtering medium is Champion Tripoli Natural Stone Tube, having over 30 square inches of filtering surface, giving it a large filtering capacity. The filter is very easily cleaned. Unscrew the thumbnut, remove the stone and brush off the accumulated filth which has been extracted from the water. This filter is made of iron, thoroughly tinned, and is handsomely finished in aluminum enamel, giving it a clean, bright appearance. A large num-

ber of dealers have added water filters to their stock and they report a very satisfactory increase in sales, and now consider the handling of filters a profitable adjunct to their business. Catalogue of our full line of water filters will be sent on application.

John C. Gunzer, Chestnut Hill, Philadelphia, is making some additions to the plumbing in Miss Heebner's residence at that place, using Cooper's goods throughout.—Adv.



Denney Improved

Rider and Ericsson

Hot Air Pumping Engines

Embody the very latest Improvements in Design and Construction.

The Most Reliable and Economical Engines for Pumping water.

Use any kind of fuel.
Can be operated by anyone.

Perfectly Safe, Noiseless,
Ever ready for Service

Built for years by

American Machine Co. WILMINGTON, DELAWARE

Agents Wanted in the West.

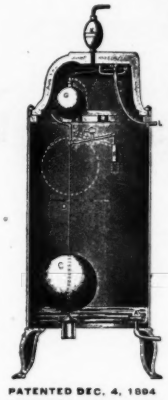
The Victor Supply Co.

Manufacturers and Jobbers of

Plumbers' Gas and Steam Fitters' Supplies

Write for Prices when in the Market.

Springfield, Ohio



PATENTED DEC. 4, 1894
PATENTED OCT. 15, 1895

Philadelphia Says It is the Best Beer Pump Made——

And our pamphlet tells why it is the only beer pump sold in town where it's made. We make attractive terms to our agents. Write us.

I.X.L. Pump Company

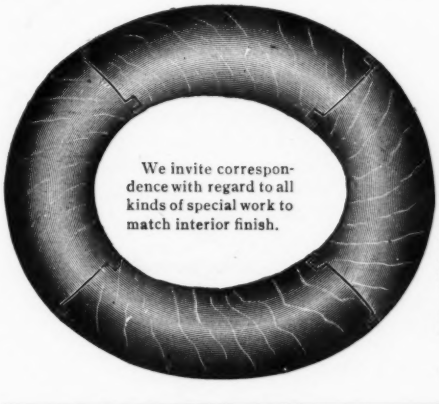
1015 Christian St., Philadelphia.

Self-Acting Hopper Valve

Very simply constructed. Has only one flat washer on inside. Repaired easily with pair of plyers. Does not hammer. Waste drains whole body of valve. Cannot waste when running. We give a very liberal discount to the trade and want agents.

The G. McG. Mfg. Co.

The G. McG. 1015 Christian St., Philadelphia, Penn.



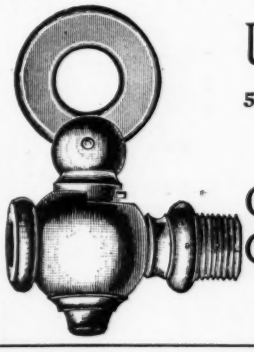
We invite correspondence with regard to all kinds of special work to match interior finish.

THE BEST PLUMBERS' WOODWORK MADE.

We make special orders in all fancy woods, such as Mahogany, Bird's Eye Maple, Sycamore, Black Walnut, etc.
We make drain boards in a superior manner, and invite sample orders.

H.B. Olmstead & Co.
87 Frankfort Street
NEW YORK CITY

Balls, Bodies, Binding Posts, Pushings, Caps, Cocks, Nozzles, Gas Stove Fittings, Nipples, Swings, Screws, Nuts, Wire Connectors Electrical Goods Etc., Etc. SPECIAL TURNING TO ORDER.



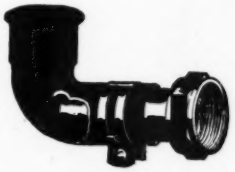
United Metal Mfg. Co.

525-527 Broome Street, New York

Manufacturers of

Gas, Electric and Combination Fittings

FROM BAR METAL



See that Clamp.

THE "CLIMAX" Rubber Adjustable Elbow.

SIMPLICITY AND PERFECTION.

DAVIS' INVENTION. PATENTED OCT. 27, 1897.

"Climax" Trade Mark Registered. Beware of Infringement.

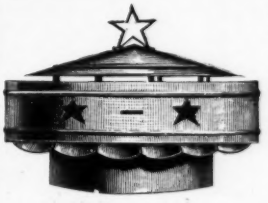
When Rubbers become worn out, they can be readily replaced by new ones. The only elbow by which this can be accomplished. Admits of greater variety of adjustment than any other. *See that our name is on all elbows.* The only Rubber Elbow having full 1¼ in. opening for flush. The largest manufacturers of Plumbers' Specialties in the world.

The Climax Specialty Co.,

Send for Catalog No. 2. SENECA FALLS, N. Y.

THE STAR VENTILATOR and

COMBINATION SKYLIGHT STAR VENTILATOR



Storm Proof, Thoroughly Efficient,

For Ventilating, Silk, Cotton, Woolen and Paper Mills, Machine Shops, Power Houses, also for Public Schools, Churches, Theatres, Etc.

SEND FOR ILLUSTRATED BOOKLET CONTAINING FULL INFORMATION.

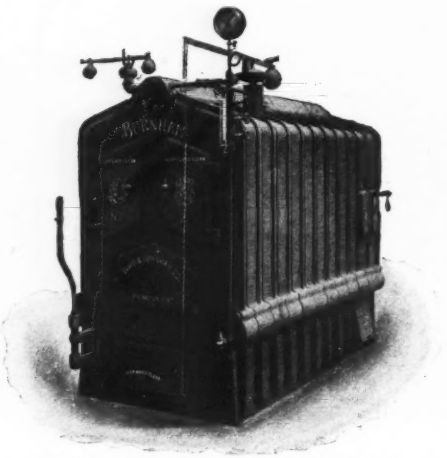
MERCHANT & COMPANY, (Inc.)

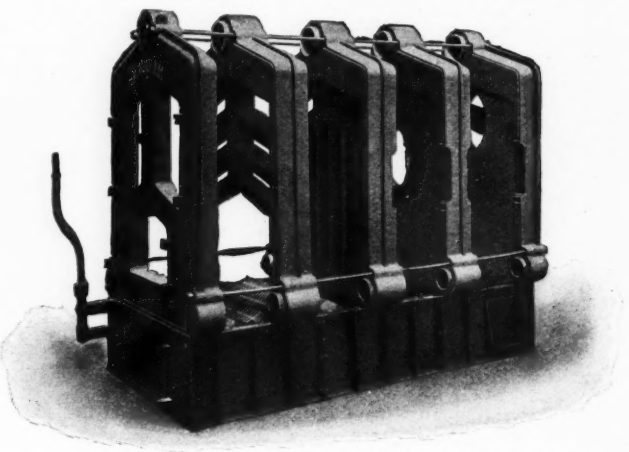
PHILADELPHIA NEW YORK SOLE MANUFACTURERS BROOKLYN CHICAGO

Southern Office, CHARLOTTE, N. C.

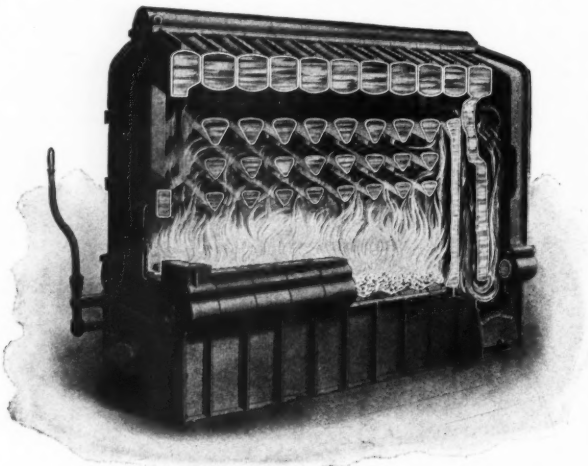
THE BURNHAM BOILER.

The "Burnham" boiler, which is the subject of our illustrations, is an improvement on the already well known Lord & Burnham Co.'s sectional heater. which during the past years has won such an excellent reputation. Owing to the increased demand among the trade for these boilers it was found necessary to increase the line and at the same time





to make some improvements. One of the most important features of the "Burnham" boilers is the method of connecting the sections. This is accomplished by means of three cast iron nipples turned with a slight taper, the sections being bored out to correspond, both operations being done to template, thus making the sections interchangeable and facilitating the erection of the boiler, at the same time securing a perfect and lasting joint.



It can be readily seen that this boiler has a large amount of direct fire surface which chiefly consists of three tiers of triangular arms. The lowest tier of arms is the smallest, the second larger, the third being the largest. By this arrangement the rays of heat strike all the arms equally, thus making the direct surface of high efficiency. The form of the arms and their upward incline towards the center and hottest parts of the boiler insures a rapid circulation, this being one of the main factors towards helping to secure the very satisfactory results which have been obtained in the use of these boilers. The products of combustion rise upward and after striking against and surrounding all of the arms pass over the fire wall section, then downward and up between the baffer and rear sections. This form of indirect travel secures the maximum economy with the minimum of friction, as no matter how long the boiler may be the indirect travel is the same, thus adapting even the largest boilers for a low draught pressure.

The grates are of the Lord & Burnham Company's palentia anti-clinker shaking and dumping pattern and so constructed that the air circulates freely around every part, thus affording the least possible chance of warping or burning out.

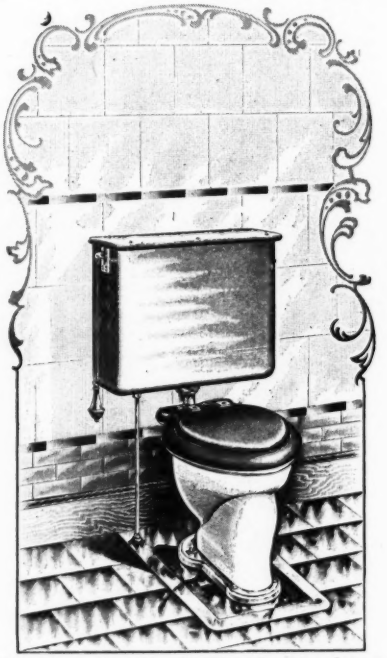
An important feature which will be found in these boilers is the method of securing a direct draught, which is a great advantage when starting or forcing the fire. This is provided for by an opening with damper in the baffer section. As most of the surface in the boiler is direct and practically self cleaning there remains but little to clean. But this is provided for by large cleaning doors in the front and sides of the boiler.

For prices write the Lord & Burnham Company, Irvington-on-Hudson, N. Y., mentioning "Domestic Engineering."

Chas. Wilkins & Co., of Minneapolis, have some good work on hand in which they will use Cooper's goods.—Adv.

THE "ZELLA" LOW-DOWN COMBINATION.

The illustration is of the "Zella" siphon wash-down combination water closet, made of vitreous earthenware, rolled rim, without jet, seat shelf and brass spud. It has a natural oak inch and quarter seat attached to the bowl with heavy brass nickel-plated hinges.



The tank is of natural oak, round cornered, copper lined with all the necessary trimmings. It has a nickel-plated two-inch flush connection, with special pipe screws, bolts and washers complete. The price of this combination is the interesting feature, and this will be furnished upon application to The Sanitary Specialty Mfg. Co., 55 N. Clinton street, Chicago, Ill., if you mention "Domestic Engineering."

Fig. 52

House Force Pumps

FOR KITCHEN SINK USE.

These pumps are adapted to a variety of purposes and are constructed as a compact, yet powerful hand force pump, especially intended for house use in forcing water into an upper story or storage tank. Made with polished iron, brass lined or all brass cylinder.

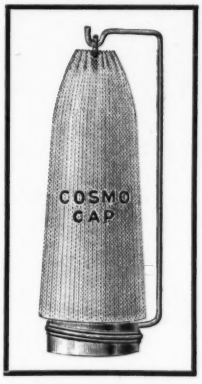
Fig. 53 is also furnished with brass tube cylinder, cylinder cock spout, brass piston rod, and stuffing nut highly polished and nickel plated, making one of the handsomest pumps ever put on the market.

A. Y. McDonald & Morrison Mfg. Co.

Established 1856 DUBUQUE, IOWA

Fig. 53

TROUBLE WITH YOUR LIGHTS? NOT IF YOU USE



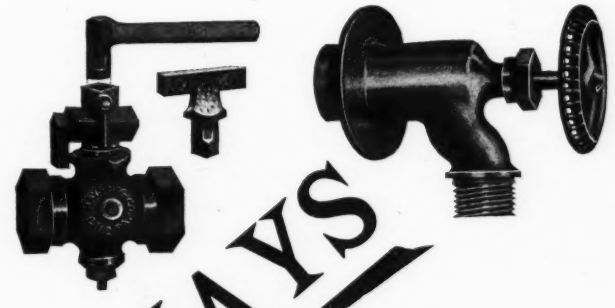
Cosmo Cap Mantle

Needs No Adjusting. Fits Any Incandescent Burner.

For Sale at all dealers **PRICE, 25 CENTS** Made by the

Cosmopolitan Incandescent Gas Light Co.

170 EAST MADISON STREET, CHICAGO



HAYS

Brass and Iron Goods

Original McNamara Hydrants and Street Washers.

HAYS MANUFACTURING CO.
ERIE, PA.

Plumbers Profit

We want every plumber to send for a free sample of

Wisconsin Graphite Pipe Joint Paste.

We want you to know by practical use, of the superior qualities of our

Pipe Joint Paste.

All joints whether steam, gas or water piping readily opened at any time.

Wisconsin Granular Graphite

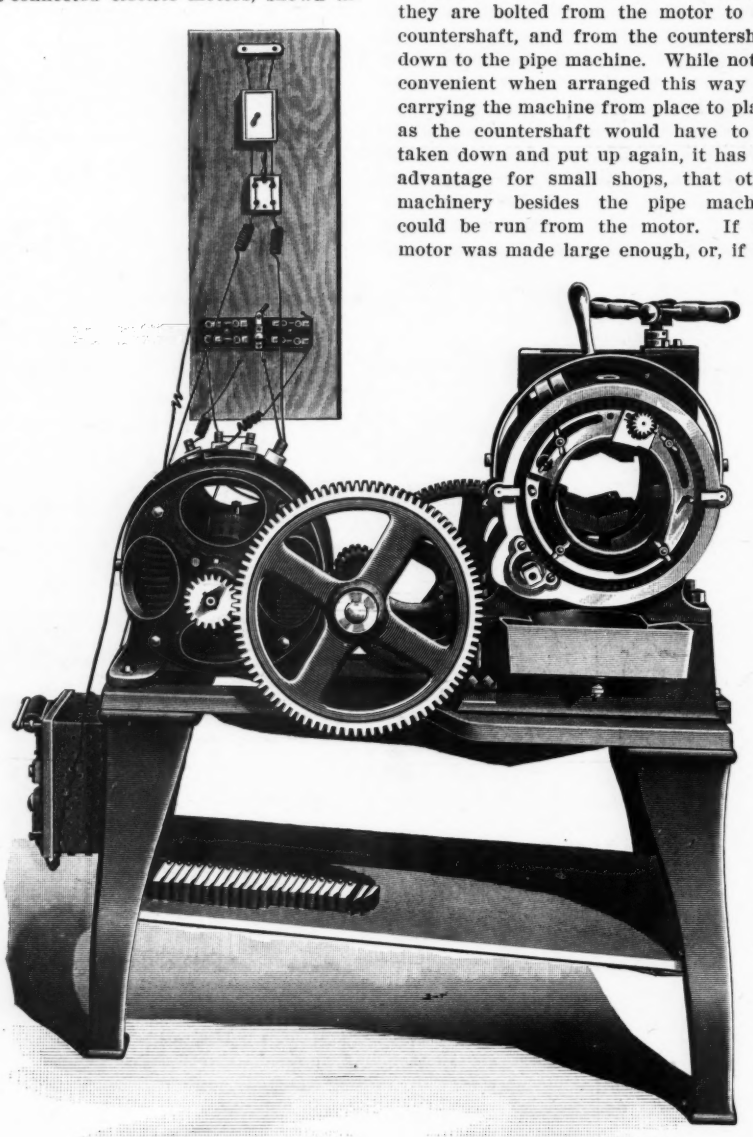
is not affected by water, steam, gas, acids, alkalis, heat or cold. Write to-day for free sample.

Wisconsin Graphite Co.

403 Market St., Pittsburg, Pa.

ELECTRICALLY DRIVEN DIE STOCKS.

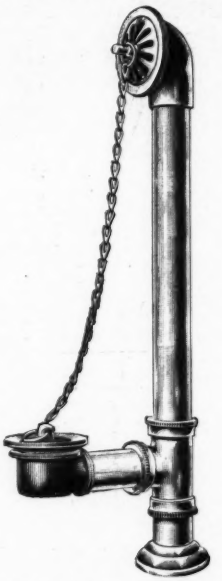
Electric motors are now being used for running machinery of all kinds wherever practicable, but the latest application of an electric motor is to the Forbes' patent die stocks, and is highly practical and desirable, especially where machines are often moved from place to place, as often as the work on which it is engaged is finished. To meet this requirement, the Curtis & Curtis Co. have equipped their Forbes' patent die stocks with direct-connected electric motors, shown in



the accompanying illustrations. These motors can be applied for any desirable voltage, and are so arranged that a varying speed can be obtained, suitable for the different speeds at which it is desired to run the pipe machine. It will be found that this equipment is very convenient when doing outside piping, as a machine connected to some convenient electric and motor can be carried to the work, current, and the work done on the spot without the pipe being carted to the machine. It often occurs that piping has to be done in unfinished buildings, or in factories on a holiday, or during repairs to the boiler plant when it would be impossible to get steam pressure, so that electric power would be the only available way of cutting a pipe excepting by hand power. For these uses this equipment will be found invaluable. The Curtis & Curtis Co. are prepared to furnish these motors separately from the pipe machine. When furnished in this way they are bolted from the motor to the countershaft, and from the countershaft down to the pipe machine. While not so convenient when arranged this way for carrying the machine from place to place, as the countershaft would have to be taken down and put up again, it has the advantage for small shops, that other machinery besides the pipe machine could be run from the motor. If the motor was made large enough, or, if the pipe machine was not in constant use, grindstones, drilling machines or other tools might be run by it. The Curtis & Curtis Co. are prepared to furnish these motors from one to fifteen horse power, and arranged from 115, 230 or 500 volts. Full particulars, prices, etc., will be cheerfully sent on application to the Curtis & Curtis Co., 18 Garden street, Bridgeport, Conn., by mentioning this publication.

A LOW PRICED WASTE AND OVERFLOW.

This illustration shows a low-priced connected waste and overflow made by A. Weiskittel & Son, Baltimore, Md.,

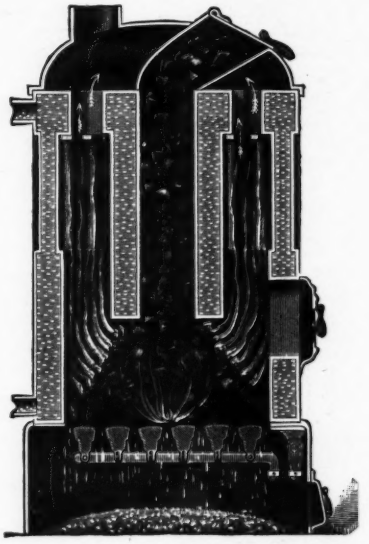


which leading jobbers say is the best one they can get for the money. It is made with special machinery and therefore commands a special price.

Frank J. Eustace, of Philadelphia, is plumbing a large house for Mr. Thomas O'Donnell, of that city, using Cooper's Reno and Nautilus closets, Special bath, lavatories, etc., throughout.—Adv.

THE HERBERT WATER HEATER.

This illustration shows the M. E. Herbert, Jr., water heater. It has a magazine or surface feed and can be used with hard or soft coal, and is said to be



the only heater on the market with a water magazine. It is manufactured by the Herbert Boiler Co., 240-242 Root street, Chicago, Ill., who will be glad to send a catalogue if you mention "Domestic Engineering."

THE I. S. C. BALL-COCK

SEND FOR CATALOGUE OF CURTIS' ENGINEERING SPECIALTIES.....

Sizes ½ inch to 4 inches in stock.

OVER A MILLION IN USE.

Valve is balanced.
Will not hammer even under pulsations of a pump.
Has renewable seat of best steam metal.
Is perfectly noiseless.
Full sized area.
Good in any place for high or low pressure.

GUARANTEED

SEND SAMPLE ORDER

JULIAN D'ESTE COMPANY

24 CANAL STREET, BOSTON, MASS.

TANKS AND SEATS

IN ANY WOOD

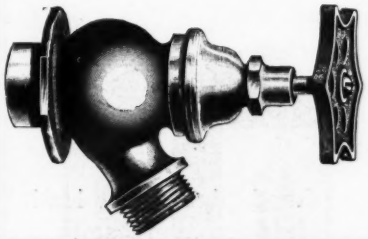
HERMANN FURNITURE AND PLUMBERS' CABINET WORKS

368-70 Broome Street NEW YORK CITY

Up to Date Finish

TRY OUR GOLDEN OAK FINISH

Wheel and Key Sill Cock



Goods for Gas Companies,
Water Companies and Plumbers

J. B. CAMPBELL BRASS WORKS.

Write for Catalogue ERIE, PA.

WHEN LOOKING FOR HIGH GRADE

CLOSET COMBINATIONS

AT REASONABLE PRICES, WRITE TO

FLECK BROS.

44 N. Fifth Street Philadelphia, Pa.

FULL LINE OF
FINE PLUMBING GOODS

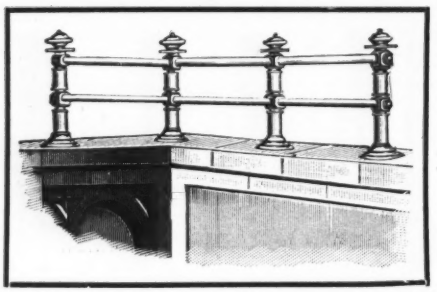
BELL MFG. CO.

MANUFACTURERS OF
STEEL CLAD AND GALVANIZED
STEEL ENAMELED

BATH TUBS

281 WATER ST., NEW YORK

PLUMBERS' FINE WOOD WORK, LOW DOWN TANK COMBINATIONS, FLUSH AND SUPPLY PIPES

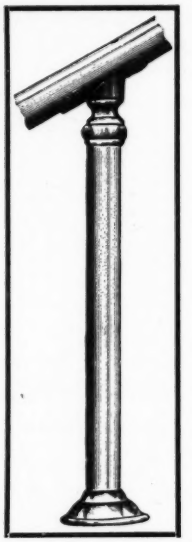


BRASS RAILING

HAND RAILS FOOT RAILS BANK RAILS
BAR RAILS STAIR RAILS STORE RAILS

ALL KIND OF RAILS

RAILS IN ANY FINISH
BRASS, BRONZE, OXIDIZED COPPER.
NICKEL, SILVER AND GOLD PLATED.



The Best Work and the Right Price.

The Columbus Brass Co., Long and Sixth Streets Columbus, Ohio.

ESTIMATES CHEERFULLY FURNISHED.

Lausten Lead Works

PRATT AND MORGAN STREETS
CHICAGO

Bi-metallic specialties
Lead traps and bends

Write for prices

Lead pipe, sheet lead
Ebony gloss plumbers' soil

Only Mechanical Grease Trap

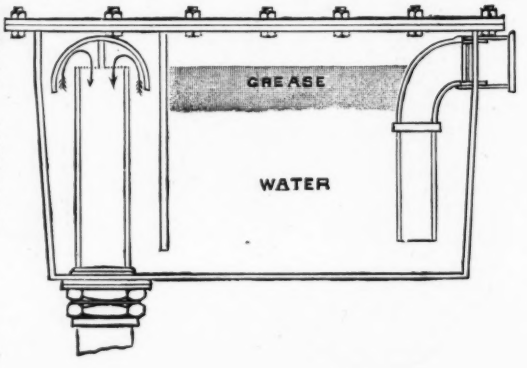
on the Market that will catch every ounce of grease

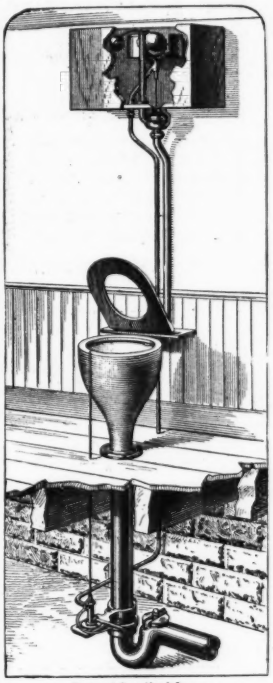
Only Grease Trap that can be easily taken apart and thoroughly cleaned.

Only Grease Trap containing an inside trap for quick action and removing of contents when desired. Connecting pipes may be increased or reduced from 1½ to 4 inches. Many other superior points will be advanced upon request.

Write for particulars

JAMES BARRETT & SON
48-50 Pearl Street and
209-211 Franklin Street
BOSTON, MASS.





The Walls & Pearsall

Anti-Freezing Closet

For Outside Locations

Can be used where other closets would freeze. Perfectly frost proof in zero weather.

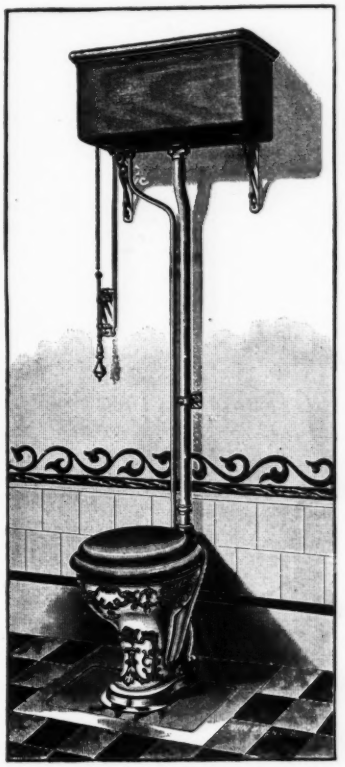
The tank contains no ball or cock washers, has no chain or pull, is simple in construction, cheap and durable. No water above frost line. An automatic flush after each using.

A small quantity of water is discharged before each using, in order to keep Hopper damp and prevent any substance adhering.

Patent Applied for.

WALLS & PEARSALL

305-307 N. Twelfth St. PHILADELPHIA, PA.



"Defender" Siphon Jet Water Closet

EQUAL TO ANY SIPHON JET CLOSET IN THE MARKET.

Complete line of tanks, seats and earthenware, also McClellan Anti-Siphon Trap Vent.

F. N. DuBois & Company, 243-247 Ninth Ave.
NEW YORK CITY

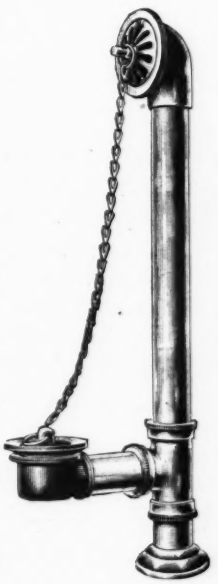
A LOW PRICED CONNECTED

Waste AND Overflow

pronounced by the leading jobbers to be the best one on the market for the money.

We have special machine for making these goods and can therefore make you special prices.

WRITE US ABOUT THEM.



A. Weiskittel & Son

Proprietors Maryland Foundry Co.

BALTIMORE, MD.

The NO-LEAK REGULATOR

GUARANTEED NOT TO STICK OR LEAK

MOST PERFECT VALVE MECHANISM FOR CONTROLLING FLUID PRESSURE.

Patent Pending.

Hugh Merrie

225 East Ninth St.,

Cincinnati, Ohio

Accessible Sewer Flushing Fittings.

Flushing Cleanout Trap.

Four Way Cleanout and Branch.

Straightway Backwater Gate.

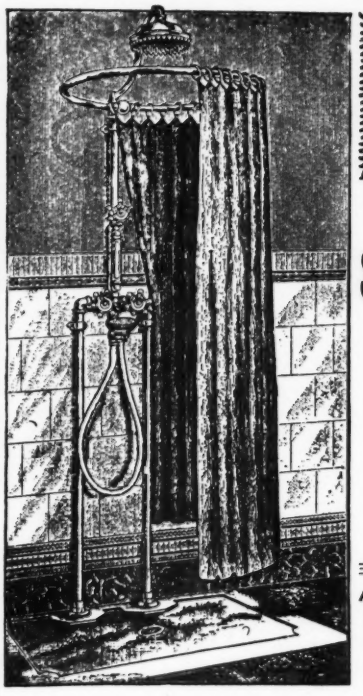
Resist sewer or backwater pressure; location of sewers always known and accessible without disturbing floors or concrete; each fitting has iron inspection manhole to surface, with tight but removable cover; flushed by hose or may be connected to main water supply.

Made for either iron or clay pipes. Backwater gates may be attached preventing flooding of cellars. Can you imagine anything better?

CATALOGUE FREE

Iron Sanitary Mfg. Co.,
52-54 Dearborn Street
CHICAGO, ILL.

SHAMPOO "Shower Baths"



Special prices to the trade on Shower and Needle Baths and Shampoo Fixtures in a large variety of our own manufacture.

Write for catalogue

Street & Kent Manfg. Company
109 S. Jefferson St.
CHICAGO

Also manufacturers of an extensive line of special designs in brass work for lavatories, bath tubs, sinks, etc. Brass work in a large variety for marble and slate closet and urinal stalls.

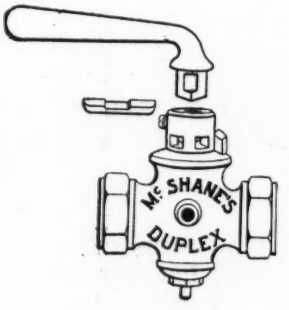
DALE
High Pressure Ball Cock

CANNOT POUND.
ALWAYS CLOSES.
ACCESSIBLE.
DURABLE.

PERFECT AND GUARANTEED.

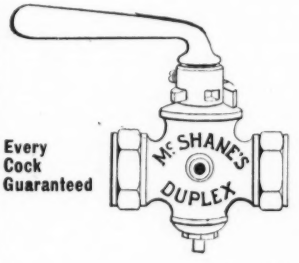
MADE ONLY BY
WOLVERINE BRASS WORKS
GRAND RAPIDS, MICH.

THE
"Duplex" Stop Cock



One of Simplest Cocks on the Market To-day

The above shows how easily the Cock can be taken apart and made either Right or Left hand as desired.



Every Cock Guaranteed

They are made of best metal and thoroughly ground

Each Cock is tested before leaving the factory

Manufactured only by
Henry McShane Mfg. Co.
BALTIMORE, MD.

You May Need Your Money!!!

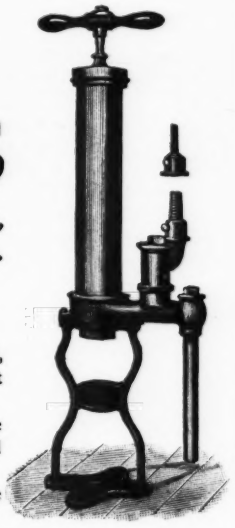
Don't buy 3 Pumps when one will do the work.

THE

PERKES

Patent Combination Air, Force and Test Pump.

Patented March 15, 1898.



Will test soil pipe, prove gas pipe, and there is no force pump made that is its equal.

No stuffing boxes; all valves are on the outside and work equally well with air or water.

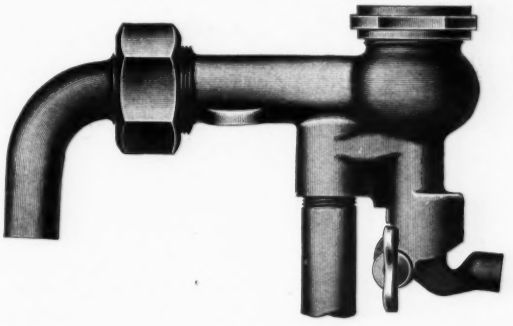
Our circular will tell you of the other good points.

CHARLES PERKES

MANUFACTURER

Established 1856 627-629 Arch St., PHILADELPHIA

The Problem Solved



The Duplex Ball Cock

GUARANTEED TO OPERATE ON ANY PRESSURE FROM ONE POUND TO THREE HUNDRED POUNDS. MADE FOR TOP, BOTTOM AND END SUPPLY. FOURTEEN SIZES AND STYLES.

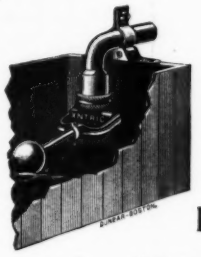
A Postal will bring you Price List and Discounts

F. W. WEBB MFG. CO.

52 to 60 Elm Street, 2 to 24 Friend Street, Boston, Mass.

YOU WANT THIS!

As you have been looking for it these many years.



The Xntric Ball Cock

For High or Low Pressure

Notice size of Ball. It is only 3½ inches

Practically noiseless. Guaranteed for two years. There is positively no hammering, and the only one on the market where the valve is closed by water pressure, and which obviates all danger of accident. Been on the market and heartily approved for three years. For use with hot or cold water.

SEND POSTAL FOR FLYER TO

Xntric Valve Co.

36 Columbus Ave. Boston, Mass.

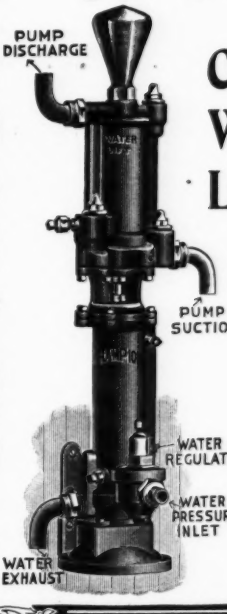
In use in Massachussetts State House and United States Postoffice, Boston.

THE CHAMPION WATER LIFT

IT PAYS

TO PUT IN THE

CHAMPION WATER LIFT



For pumping cistern water or for increasing city pressure it is the BEST.

IT WORKS PERFECTLY.

That is our guarantee, and our name is guarantee that the construction is right. Handled by all large jobbers. Write for catalog.

MADE ONLY BY

THE CLEVELAND FAUCET COMPANY

CLEVELAND: 15-27 Frankfort Street.
NEW YORK: 4 Great Jones Street.
CHICAGO: 92 Franklin Street.
SAN FRANCISCO: 202 Ellis Street.

THE CHAMPION WATER LIFT

All first class Plumbers are using the New Style

Broughton Self Closing Basin Cock

NO EXPOSED SURFACES, EASILY KEPT CLEAN

THE BROUGHTON SELF-CLOSING BIBBS & COCKS HAVE BEEN ON THE MARKET SEVERAL YEARS - SUPERIOR TO ALL OTHERS FOR SIMPLICITY AND STRENGTH - EVERY ONE WARRANTED.

Send for Circular and Price List

E. STEBBINS MFG. CO.
SPRINGFIELD MASS.

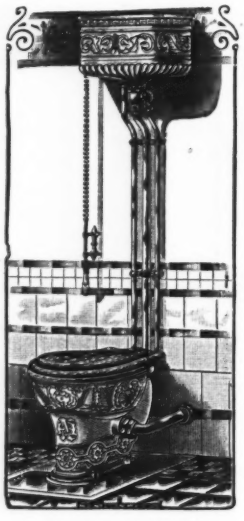
A GOOD ARGUMENT
IN FAVOR OF THE
Lyons Cocks

More of them sold last year than ever before. We are gratified to know that the trade appreciated our efforts to give them a first class article at a reasonable price. There are none can equal the Lyons Cocks.

MANUFACTURED BY

CLEVELAND BRONZE & BRASS WORKS
CLEVELAND, OHIO

PLUMBERS' SUPPLIES



Nelson Syphonia Water Closet

Pneumatic syphon

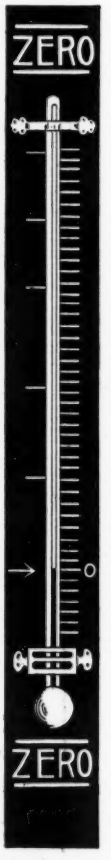
PRICE REDUCED
QUALITY RAISED

N. O. NELSON MFG. CO., SAINT LOUIS

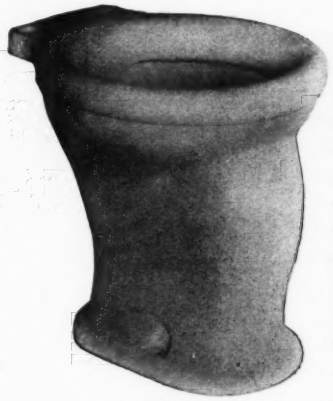
Zero Quick Wasting Hydrant,
Zero Jr. Hydrant,
Zero Self-Closing Hydrant.

Large Wastes, Quick Action, Non-Freezing.
Cheapest and best Hydrants in the world.

Zero Brass & Valve Mfg. Co.
BUFFALO, N. Y.



To the Plumbing Supply Trade:



No. 1. Plain Washdown

This cut represents our new improved plain wash down, which is made with walls one inch thick insuring unusual strength, thereby reducing liability of breakage to a minimum; it is therefore particularly adapted for public buildings, schools or any public place where closets are subjected to hard usage, and is designed to take the place of imported or domestic fire clay closets, and being constructed of a hard vitreous china body it is guaranteed against crazing. We can also furnish these closets with syphonic action or syphon jet.

We manufacture everything in the sanitary earthenware line and pay particular attention to specialties. All closets being tested before leaving our works, we guarantee their working qualities.

Bellmark Pottery Co.

P. O. Box 547. TRENTON, N. J.

THE REX.

THE KING

of them all.

Syphon Hopper and Trap Combined.

Surpassed by no Closet on the Market.

This closet has **full water ways** through all the **syphon pipes, a large water surface** and 3 inch Seal. It is made for high or low tank. Embossed or plain surface.

Earthenware Specialties designed and finished with unsurpassed art and workmanship.

The Sanitary Earthenware Specialty Company

Trenton, N. J.

ECLIPSE ROUND WATER HEATERS

We think:
Round Water Heaters are the best form. Take room which is useless for other purposes. Our Round Heaters better than those copied after ours, but not possessing our advantages.

Why low prices?
Built special machinery; must have volume to keep going; their sale stimulates gas range business.

Merits:
Our Heater, under severest tests, has from 35 to 50 per cent greater efficiency than others.

New Catalogue, just ready; mailed on request, mentioning Domestic Engineering

Eclipse Gas Stove Company

ROCKFORD, - ILLINOIS

—THE—

ORINOCO Syphon Jet Closet.

This Orinoco Syphon Jet Closet is what you should have. This is the most perfect and noiseless closet now manufactured. The workmanship and High Grade Finish of the Orinoco Closet cannot be excelled.

IT SPEAKS FOR ITSELF TRY ONE AND BE CONVINCED.

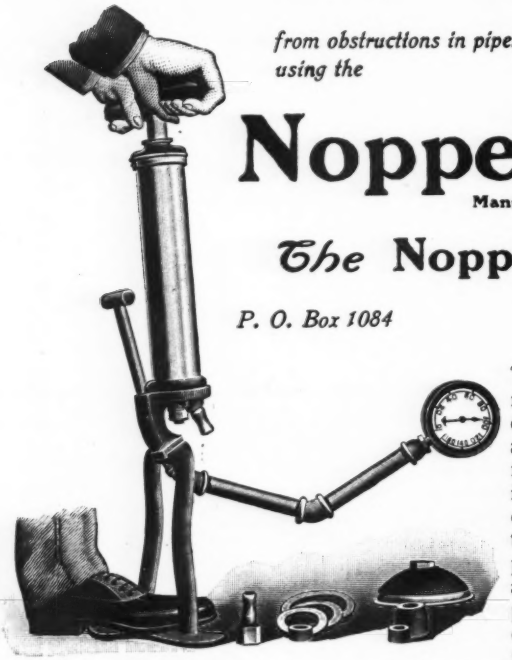
MANUFACTURED BY

THE KING MFG. CO.

LIMITED.

205 Wood Street, Pittsburgh, Pa.

No More Trouble



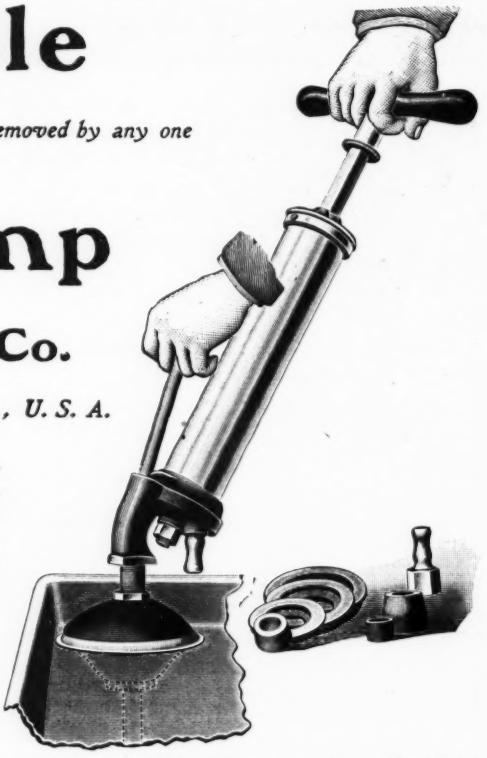
from obstructions in pipes. They can be easily removed by any one using the

Noppel Pump

Manufactured by

The Noppel Pump Co.

P. O. Box 1084 *HARTFORD, CONN., U. S. A.*



This pump is a Combination Lift, Force, Discharge and Test Pump and you can not only force air, liquid or gas into pipes, but can continue to do so, getting an ever increasing pressure. With no alteration in fittings or position of pump you can instantly change from force to suction and continue to exhaust air or draw out and discharge water and loose material. **No Other Pump has these Advantages.**

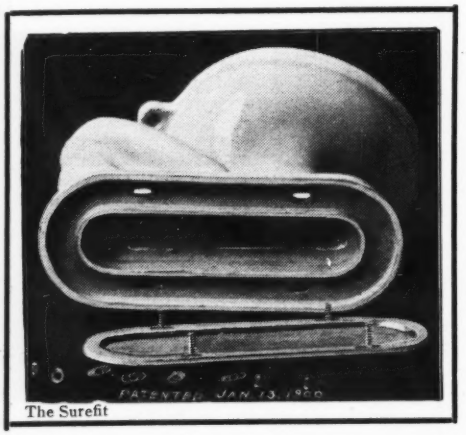
SEND FOR CIRCULAR

INDESTRUCTIBLE **SIMPLE IN CONSTRUCTION** **EASILY OPERATED**

Paste this in the catalogue you use most:

You may not need it to-day, but you certainly will have to have a

SUREFIT



The Surefit

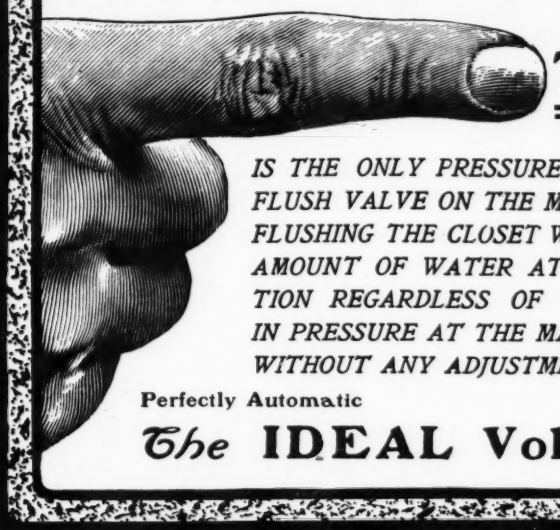
The floor connection is sure to be tight. The first flush tests it. Ask your jobber for price.

The Trenton Potteries Company's goods are sold only through Plumbing Supply Houses.

The Trenton Potteries Company was awarded two grand prizes at the Paris Exposition, in competition with the entire world—a Gold Medal in the Hygienic Department and another in the Department of Ceramics—the Highest Award granted on Sanitary Fixtures and Decorative Ware.

THE TRENTON POTTERIES COMPANY, TRENTON, N.J.

Finest Grades of Sanitary Earthenware and Vitrified China, Solid Porcelain Bath and Laundry Tubs, Sinks, Etc.

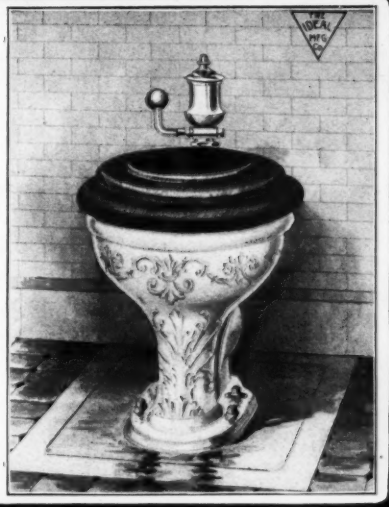


THAT

IS THE ONLY PRESSURE REGULATING FLUSH VALVE ON THE MARKET. FLUSHING THE CLOSET WITH THE SAME AMOUNT OF WATER AT EACH OPERATION REGARDLESS OF FLUCTUATIONS IN PRESSURE AT THE MAIN OR SUPPLY WITHOUT ANY ADJUSTMENTS.

Perfectly Automatic Patented

The IDEAL Volumeter



THE IDEAL MFG. CO. DETROIT MICH.

The IDEAL Mfg. Co.

Manufacturers of

Fine Sanitary Specialties

DETROIT MICH.

THE IDEAL MFG. CO. DETROIT MICH.

The

"Sedate"

We Handle all grades of Low Down Tank outfits, including syphon jet, syphoning hoppers with jets and plain hopper and trap combinations.

We Manufacture the "QUIET" syphon jet and the "SEDATE" syphoning hopper outfits and recommend them to all who desire a thoroughly high grade and highly perfected outfit.

The TANKS, seats and lids are made from carefully selected hard woods, which are highly finished. The "Quiet" and "Sedate" tanks have heavy tinned copper linings and all seams are locked and carefully soldered.

Haines, Jones & Cadbury Company

1128-44 Ridge Avenue
1423 Chestnut Street

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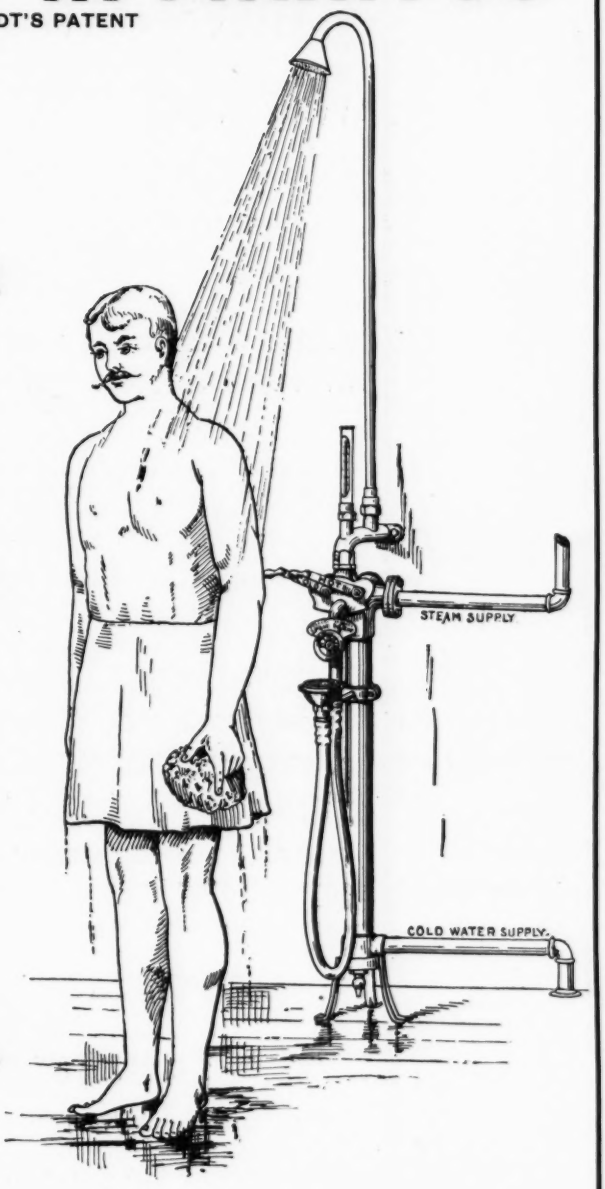

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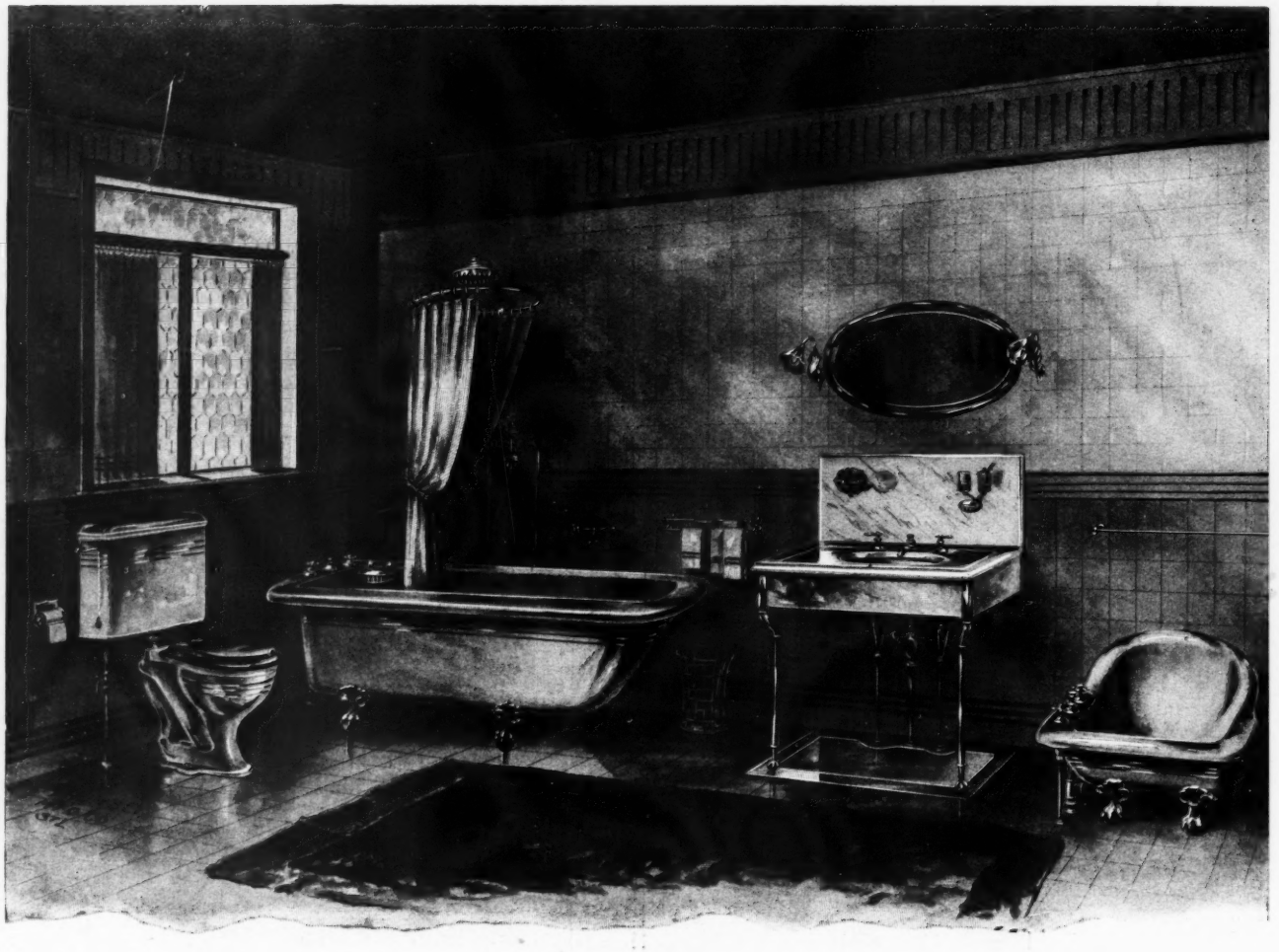

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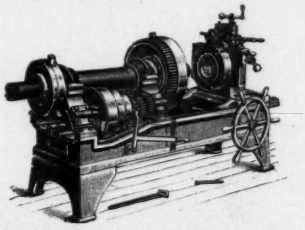

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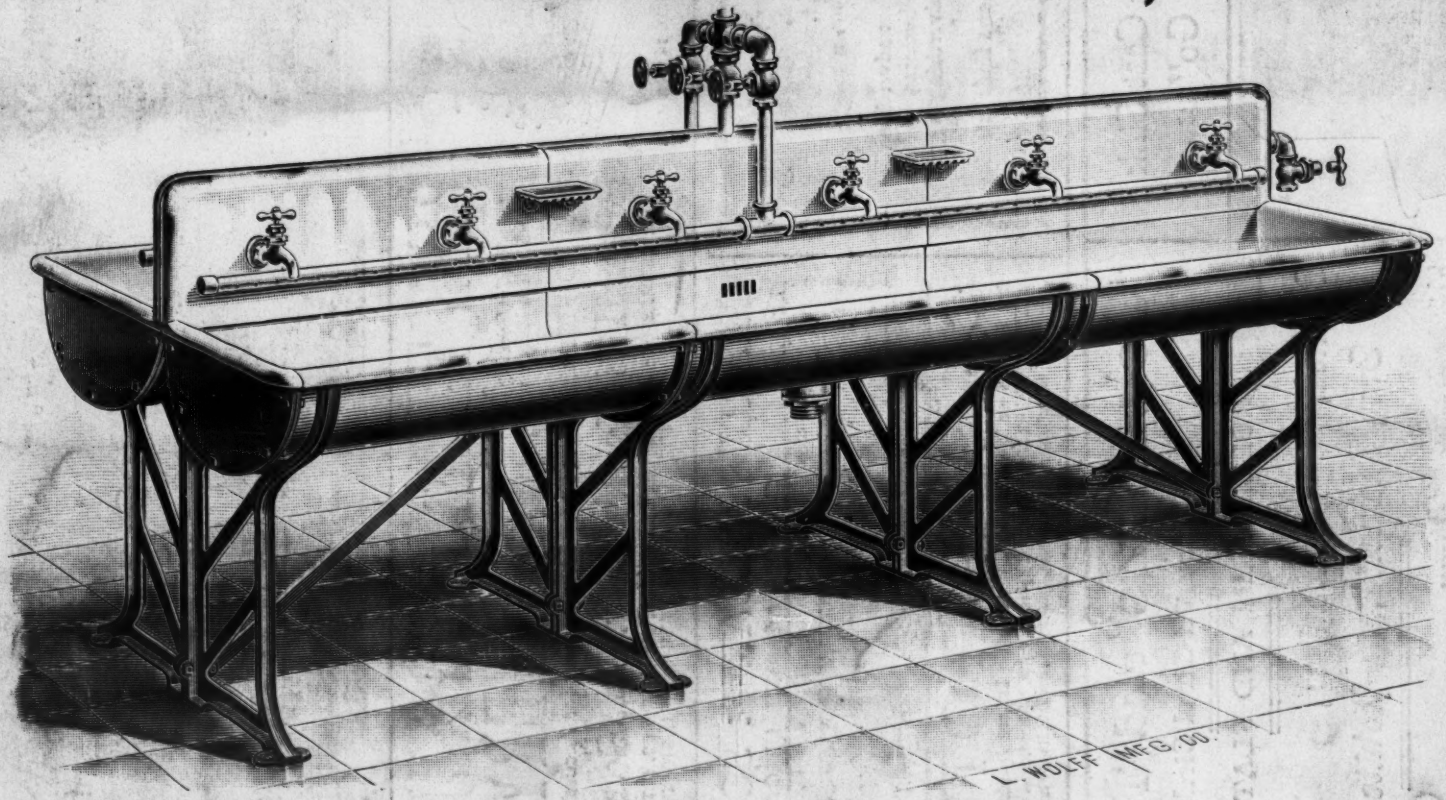

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